JULY 1913

MODERN ELECTRICS

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A NINE-MILE SIPHON—PART OF LOS ANGELES' HYDROELECTRIC SYSTEM

THE ELECTRICAL MAGAZINE
FOR EVERYBODY

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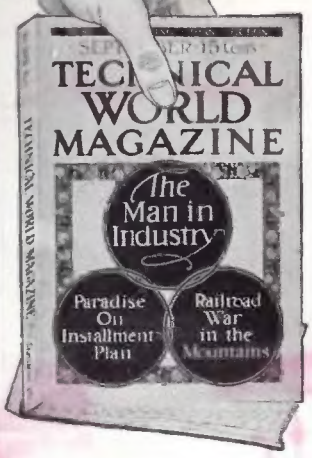

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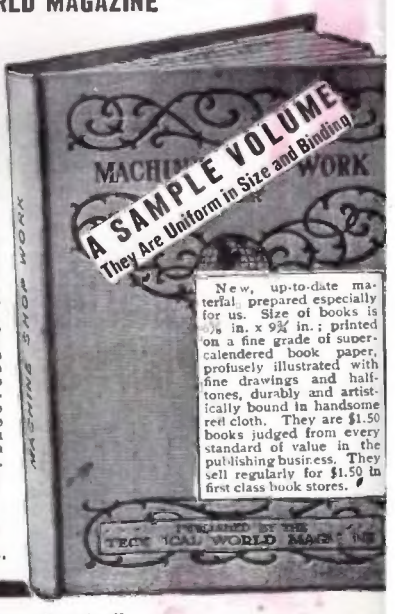
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MODERN ELECTRICS

"The Electrical Magazine for Everybody"

Charles J. Rosebury, President. Charles A. LeQuesne, Jr., Editor.

Volume 6. July, 1913 No. 4

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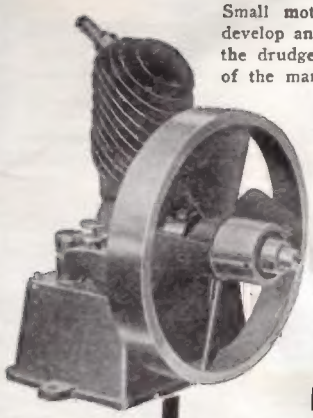

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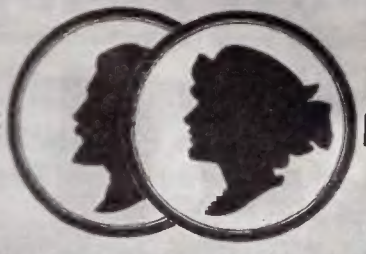

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VOL. VI. July, 1913 No. 4

A Mammoth Municipal Electric System

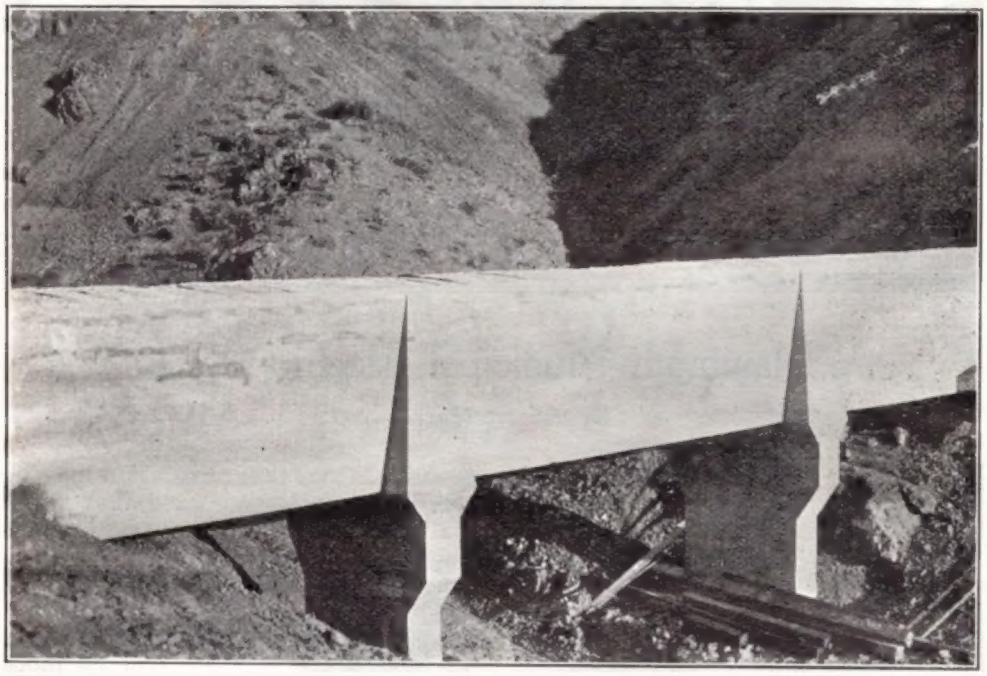
By Albert Marple

THE city of Los Angeles, Cal., is just completing what is doubtless the finest municipal electricity system owned by any city near its size in this country. E. F. Scattergood, chief of engineers of the Los Angeles aqueduct, stated recently that this power would doubtless be ready for delivery to Los Angeles people by July 1st, and that the first bundle of this commodity to be presented to the city would be a parcel containing 37,500 horse-power, this coming from Power Plant No. 1, the first one to be completed. Later, after Plant No. 1 is finished and in operation, Plant No. 2 will be erected, and this latter will swell the horse-power obtainable from this section of the electrical system up to 120,000. Chief Engineer Scattergood says further that in conjunction with the added power that can be developed from the contingent streams along the Owens River water shed an aggregate of 165,000 horse-power will be available.

This power is being brought to Los Angeles at a cost of $6,000,000. This is the figure set in the estimate, but it is possible that this calculation may be exceeded. It is estimated that when completed and in operation the Los Angeles municipal system will be worth between $50,000,000 and $75,000,000. This is believed to be a conservative estimate and many believe the system's real value will be more than $100,000,000. This power is being carried to Los Angeles from the San Francisco canyon, which lies south of the Owens River country or a distance of about one hundred miles from Los Angeles. Thirteen hundred men are at work at this time and those in charge say that if the undertaking is to be completed in the specified time, a force of this size must be kept at work during the entire period. The actual work on this Power Plant No. 1 was started December 9th, 1911. Hundreds of tons of concrete and thousands of tons of steel will be used in the mammoth siphon through which the water will travel.

The penstock line will be thirty-four hundred feet long. The first twenty-five hundred feet will consist of three seven-foot steel pipes, then each line

will diverge into two smaller ones and the distance to the plant will be covered by six five-foot pipes. The tunnels lead from the Clearmont reservoir and are to be operated under pressure corresponding to the head of water in the reservoir. The top of the surge chamber will be on a level with the reservoir's high water mark. The chamber is an impressive and useful part of the conducting system. It is 140 feet high, 100 feet in diameter at the top and thirty feet in diameter at the bottom. It is lined with a coating of concrete five feet thick. It has been excavated in granite rock and will last hundreds of years.



REINFORCED CONCRETE FLUME CARRYING THE WATER ACROSS A LOW SPOT

The San Francisco section of this system consists of two "drops"; the first is from the reservoir to Power Plant No. 1, which is 940 feet; the second being a fall of 530 feet from Plant No. 1 to Plant No. 2.

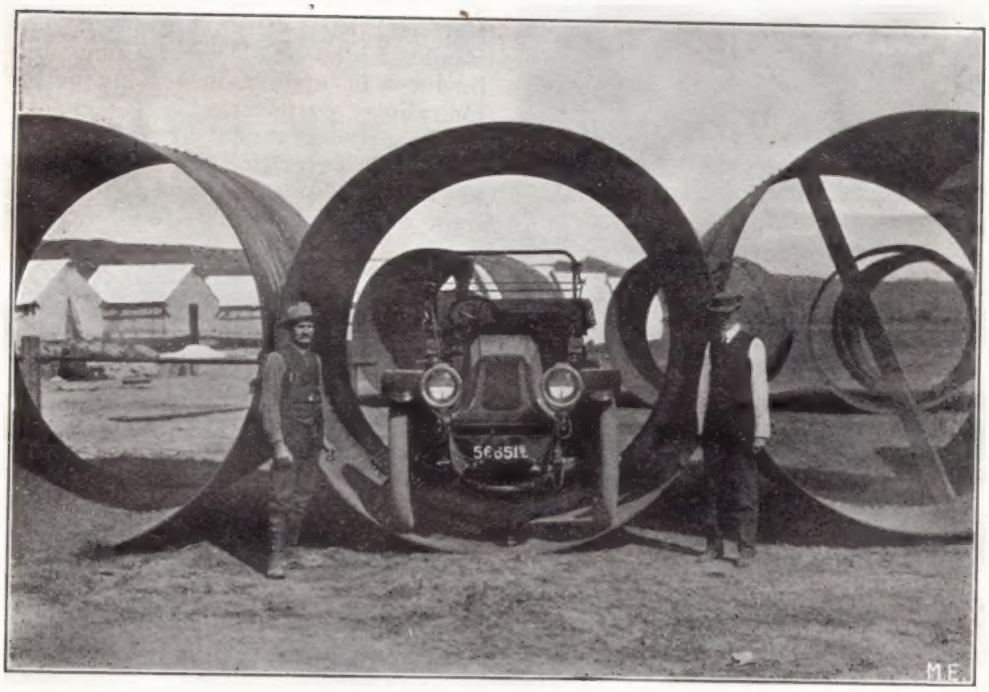
There are 13,618 feet of tunnels in the upper power project, in addition to the Elizabeth tunnel, and 30,460 feet in the lower power project, making a total of 44,078. This is exclusive of the tunnel known as the No. 72-A, which will have to be constructed from the lower power house site to the first tunnel in the Saugus division, a distance of 2,700 feet. The tunnels in the upper power drop are in medium hard granite, those in the lower are in sandstone and schist, some of it soft, wet and blocky, requiring heavy timbering and concreting as soon as excavated. In the short time since this section of the work was started, 30,698 feet of these tunnels have been driven, or 5.8 miles, while 1,517 feet have been lined with concrete. The distance between the two plants is six and a half miles by a line of tunnels. Three 14,000 horse-power units are being installed in Plant No. 1, as are also a transmission station and line, and two 3-phase 110,000 volt circuits to the city. A central receiving station is also being erected in Los Angeles. The tunnels leading to the two plants are being handled as joint work. The installation at the present time at Plant No. 2 will take care of a maximum load of 37,500 kw. at the city.

By transmitting the power at a nominal voltage of 110,000 it is believed that the loss of transmission will not exceed 10 per cent., and the aver-

age loss during the day will be less. The total investment with a system of this nature complete has been, after careful estimation, named as $75 per horse-power. The cost per horse-power along the aqueduct proper will be only $60. It is stated that 45,000 additional horse-power may be developed in the future if found necessary, but that this extra power will probably cost from $110 to $115 per horse-power. Even at that figure it would be a good investment, as many corporations and municipalities have found it profitable to develop power at from $250 to $300 per horse-power.

When the plant is completed and producing 120,000 horse-power, as it will do, it will be furnishing 62,500 hourly kilowatts. At one cent per hour this would produce a gross annual revenue of $5,475,000, more than half of which would be net profit. At 0.45 cents, which is lower than any wholesale price ever quoted in this locality, the revenue would be in excess of $2,500,000. This on an investment of $6,000,000. The people of Los Angeles are now contemplating bonds to the amount of $9,000,000 additional for a distributing system for this electricity, $6,500,000 of this amount to be used for the main distributing system, while $2,500,000 is to be expended for the beginnng of the work on the Pasadena-Glendora, San Dimas "high line" of the aqueduct.

While the Owens River aqueduct project was intended, at the outset, to simply furnish water to the residents of Los Angeles and adjacent territory, the electric power-developing possibilities thrust themselves upon those in charge of the work so forcibly that they could not be allowed to go unheeded. The water is being carried, at a cost of $24,500,000, from the Owens River, about thirty-five miles above Owens Lake, to Los Angeles, a distance of about 250 miles. Owens River rises on snow-capped Mt. Whitney in the Sierra Nevada Mountains at an elevation of over 10,000 feet above sea level and flows a distance of 90 miles southerly into Owens Lake. This mountain torrent is fed principally by snow waters. Tapping this stream as it does about thirty-five miles above Owens Lake, the waters of the aqueduct travel through canals, tunnels,



SOME OF THE SECTIONS OF THE STEEL PIPE LINE

siphons and conduits across the Mojave Desert to the power stations, thence on to San Fernando Valley reservoirs and into the municipal mains.

Two bond issues have taken place to furnish funds for this work. The first

ONE OF THE STEEL PEN-STOCKS LEADING DOWN TO THE TURBINES

was for $1,500,000, the second being for $23,000,000. The work was started in 1907, and when the plant is finished in 1913, it will have been in course of construction six years. More than 1,500,000 barrels of cement are being used in the building of the aqueduct as well as thousands of tons of steel. Along the line of the aqueduct the city built and now owns a modern Portland cement mill, which has a capacity of 1,200 barrels a day; three tufa cement mills with an aggregate yearly capacity of about 300,000 barrels. For the past five years an average force of 3,500 men have been employed on this aqueduct at an average yearly expenditure of about $3,305,195. The city has purchased from the United States Government 135,116 acres of land for an average price of $1.25 per acre.

At the present time the Edison Electric Company and the Los Angeles Gas and Electric Company each handle about 40 per cent. of the local electrical business, while the remaining 20 per cent. of the business is taken care of by the Pacific Light and Power Company. The Edison does a big business outside of Los Angeles, while the Los Angeles Gas and Electric Company's business is mostly inside the city, and a sale of all the distributing systems to the city would probably involve the abandonment by this company of the electrical part of its business. The Pacific Light and Power Company's business is, mainly, in serving power for railway purposes.

The present annual aggregate consumption of electricity in Los Angeles for municipal purposes and commercial light and power, exclusive of railway

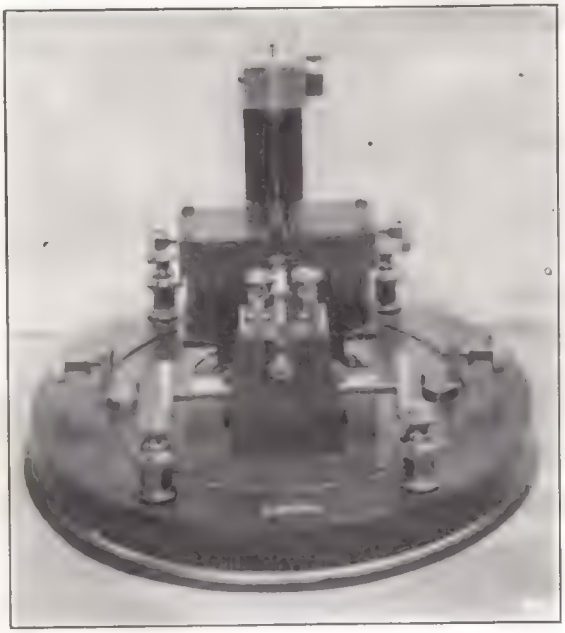
A TEN-FOOT SIPHON NINE MILES LONG

power, is about 30,000 horse-power, so that the 37,500 horse-power to be furnished by Power Plant No. 1 will cover all needs of the Los Angeles people for the present and even for some time to come.

The "K K" Detector for the Railophone

By Austin C. Lescarboura

IN the June edition of *Modern Electrics* an article was published describing the English railophone—a system of signaling to and from moving trains and stations or other fixed posts. The success of this signaling system is due to the introduction of an extremely sensitive and highly improved alternating current relay, which is known as the "K K" detector.



THE DETECTOR WITH COVER REMOVED

In the early research work in connection with the development of the railophone it was found desirable to obtain some method of "calling up" which would be sufficiently audible or visible to eliminate the necessity of constant attendance on the part of the operator. It was necessary to have this instrument sufficiently sensitive to respond to currents to the order of 2×10^{-4} amperes flowing under an E. M. F. of about 2×10^{-2} volts at a frequency of 100 cycles per second. Although there were several relays on the market which worked on even feebler currents, they required far greater voltage than could be obtained in the receiving circuit of the railophone. Another important requirement of the instrument was that it should not be affected by mechanical shocks or vibration in moving trains. This latter requirement was possessed by no existing type of relay, so that Mr. H. von Kramer, the inventor of the railophone, in conjunction with Dr. G. Kapp, professor of Electrical Engineering at the Birmingham University (England), developed the K K detector relay which is not only suitable for "calling up," but may also be employed for any other purposes for which the ordinary telegraph relays requiring far heavier currents are usually employed.

The design of the K K detector has been governed by the three essentials controlling the sensitiveness of an alternating current relay, viz.: The minimum voltage at which it will operate with reliability; the minimum current at which it will operate with reliability, and the frequency of the alternating current. In sensitiveness this relay is said to be unrivaled and it has the further advantage of being impervious to shocks or vibration.

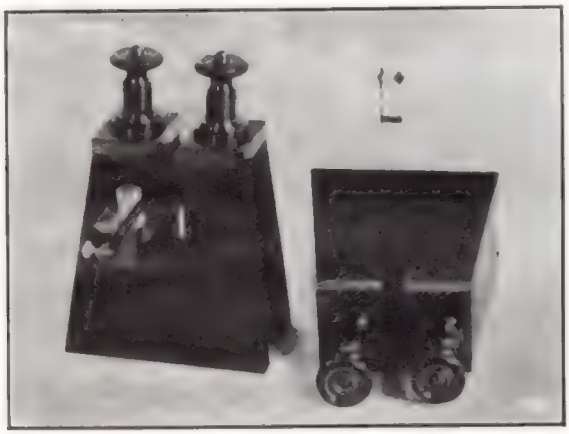
In principle the K K detector consists of the following essential parts:

(a) A steel reed or strip, securely fixed at one end, with a natural frequency corresponding to that of the alternating current circuit in which the instrument is to operate.

(b) A permanent magnet steel frame of the shape shown in Fig. 1, of which the steel reed forms one polar extension; the free end of the reed thus gaining the polarity and the char-

acteristics of the pole of the permanent magnet to which it is fixed.

(c) To the other end of the steel frame of the permanent magnet described in the foregoing paragraph, a laminated soft iron wire core of the form shown in Fig. 2 is attached, thus forming the other polar extension. While the two ends of the laminated core are of similar polarity, they are of opposite polarity to that of the free end of the reed which extends downwards between the two ends of the laminated core, as shown in Fig. 3. The free end of the reed normally remains in the center of the small air gap between the two core ends, inasmuch as the attraction between either end and the reed is equal. Provision is made whereby the total air gap between the two limbs of the core, or the gap between the reed and either limb may be increased or decreased, as may be required under the varying conditions of service.



TWO VIEWS OF THE REEDS CARRYING THE CONTACTS

(d) On each limb of the laminated core a magnet coil is mounted, both of these coils being connected in such a manner that on passing an alternating current through them, polarity is superposed on the permanent polarity at the core extremities; the alternations corresponding to the frequency of the circuit. As an illustration, if the instrument is employed on a circuit of 100 cycles frequency, the polarity will be built up and reversed 100 times per second at each extremity. The reed, having the same periodic time as the vibrating field in the air gap, is attracted by the one and repulsed by the other core extremity when even the most feeble current is passing through the coils.

(e) The vibrating reed is utilized to operate a contact device. Inasmuch as any attachment to the free end of the steel reed would be detrimental to the extreme sensitiveness of the instrument, the design of the contact members of the relay has been arranged so that the natural periodic time of the reed is retained without encumbering its movements by the addition of platinum points or other contacts. The reed does not close the local circuit directly, but simply actuates a mechanical contact-making device comprising two parallel non-magnetic flanking reeds of much lower periodic time than the steel reed. The ends of these reeds are fixed to insulated metal supports which carry terminals. Each flanking reed is fitted with a platinum contact point which normally presses against that on the other reed. Between both reeds an insulated ivory roller is placed, the function of which is to prevent the delay in the separation of the platinum points, which would otherwise result from the spring effect in the reeds necessary to maintain the contact between the points. The steel reed which is affected by the alternating current flowing through the windings, is suspended between and at right angles to the two horizontal flanking reeds. At the free end of each of the flanking reeds is fixed an ivory point; the air gaps between these points and the vertical reed being such as to allow the latter to be free at the beginning of its movement, so that it can attain sufficient momentum to forcibly strike against the ivory points on either side of it. Thus the platinum points on the flanking reeds are kept apart as long as the reed continues to vibrate. The two flanking reeds with their platinum contact points may be used to form part of the local circuit, acting as a single pole switch. For highly sensitive work a system of four flanking reeds is employed with separate and

independent adjustment of the contact points and the ivory points.

By adjusting the air gap between the core extremities, the detector can be made to respond to various frequencies above or below the natural frequency of the reed. Not only is it possible to adjust the instrument to operate within limits of 1 per cent. in either direction, but where increased E. M. F. is available on the line terminals the detector will respond within a wide range of frequencies. The resistance of each coil of the standard K K detector is 220 ohms, and as the two are connected in parallel, the total resistance of the coils at the line terminals is 110 ohms. For the secondary circuit of the K K detector a four-volt battery is employed, and the resistance of the circuit must be such that the current passing through the platinum contact points will not exceed 0.1 ampere.

Aside from its use in the railophone, the K K detector may be applied to several other purposes, among which are: As a contact device operating on long distance transmission circuits where the incoming current is extremely weak; to detect leakages in alternating current mains; in telephone and telegraph work to relay currents that can be scarcely detected in an ordinary telephone receiver, but which, by the use of the detector, become distinctly audible; to record such sounds as the firing of a rifle shot, the clapping of hands, musical notes or voices, providing that the detector is tuned to the frequency of such sounds; and, finally, in wireless telegraphy to detect ordinary wireless signals providing they are sent at a frequency of about 100 periods per second, enabling the operation of emergency warning bells and similar devices.

DANGER OF ELECTRIC CURRENTS*

In this paper it was asserted that the danger of high-tension current is expressed by the amount of tension, and that besides the voltage there were other factors, for instance, the amount of current. It was stated quite correctly therein that in general 300 volts of alternting current would be considered as dangerous to life, or "deadly," and that also much lower tension would produce death. It would be, however, interesting to most persons to know just what the combinations are, that may be considered as dangerous with a low tension.

Dr. Jellinek states quite correctly that 0.01 ampere may be considered as dangerous. We may consider a current dangerous that will, under ordinary conditions, send 0.01 ampere through the body; but we must take into account the resistance that the human body offers to the passage of the current. The dry human skin has a resistance of about 50,000 ohms per square centimeter of surface, or say $50{,}000 \div 6.45 = 7{,}752$ ohms per square inch. If then we touch poles in such manner that only one square inch of each hand is in contact, we have introduced a resistance of say 15,500 ohms—leaving out of account the 500 ohms or so of the entire body. In order to drive 0.01 ampere through a resistance of 15,500 ohms there is needed a tension of $15{,}500 \times 0.01 = 155$ volts; and if we touch the conductor with the whole palm of our hand, or say about twenty square inches, then the resistance will be only 750 ohms. If the other pole is touched with only ¼ square inch there will be interposed in all 750 for the one hand, 500 for the body and 31,000 for the other hand, equal in all 32,250 ohms, which would require $32{,}250 \times 0.01 = 322.5$ volts in order to produce disagreeable results. If both poles are so grasped that there is a contact surface of 20 square inches, there will be a resistance of $750 + 500 + 750 = 2{,}000$ ohms, calling for only $2{,}000 \times 0.01 = 20$ volts to be dangerous. This being the case, it is easy to see that even 20 volts can be dangerous.

Director Glotz, of Arnstadt, in calling attention to the voltage required to produce danger, notes that an alternate current would be much more disagreeable and dangerous, as the effects would be those of the maximum value, or the square root of double the tension = about 1.42 times as great as for continuous current.—*Robert Grimshaw.*

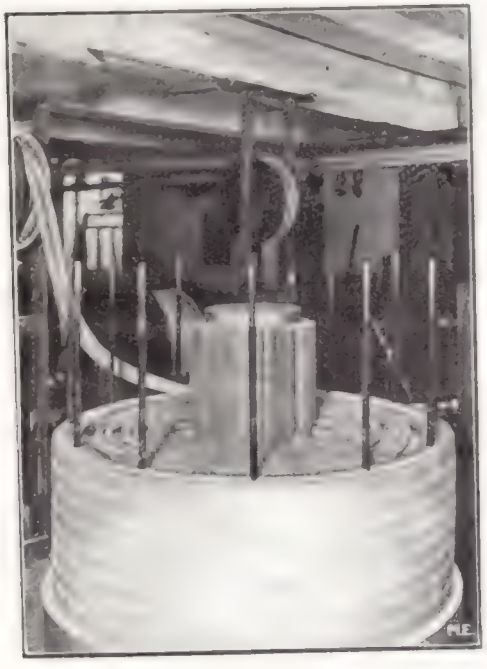
*From a paper by Dr. S. Jellinek, before the Elektrotechnischer Verein, Vienna.

Reactance Coils for Protecting Electric Central Stations

By Frank C. Perkins

THE accompanying illustrations and drawings show the construction of the Metropolitan porcelain clad reactance coils of the Murray type, designed at Brooklyn, N. Y., for protecting generators, feeders, etc., against excessive currents when short circuits occur.

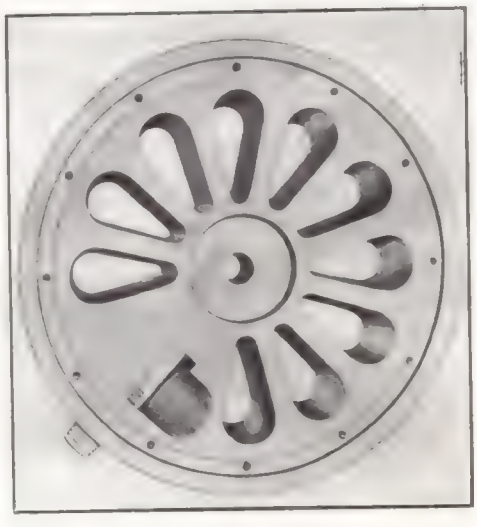
It is well known that in central stations distributing alternating current protective reactance coils in connection with lightning arresters on overhead lines have been in successful use for a long time. During the past decade prominent engineers have advocated that central stations adopt protective reactance, connected to generators,



MULTIPLE WINDING FOR A LARGE REACTANCE COIL

transformers, busbars and feeders in the generating stations. These reactances are placed at some or all the points where they are considered most necessary as on the leads of generators or transformers feeding busbars. They are also used on the busbars, between different sections of busses and on the feeder circuits.

These protective reactances when so located fulfill the main function of limiting the amount of current that may flow from any part of the system into a short circuit in apparatus or connection inside the station or close to the station. By so limiting the abnormal flow of current into a short circuit, the generating sys-



CONCRETE HEADER AND TERMINAL BUSHING FOR A GENERATOR REACTANCE

tem as a whole is relieved from possible disastrous effects of short circuits.

At the time of disturbance on the system when the generating frequency and voltage are momentarily lowered, the reactances will reduce the energy output and thereby minimize the change in frequency which often throws out of step the synchronous apparatus at the substations and the generators of interconnected stations. The added reactance also makes the circuit more reliable for synchronous operation.

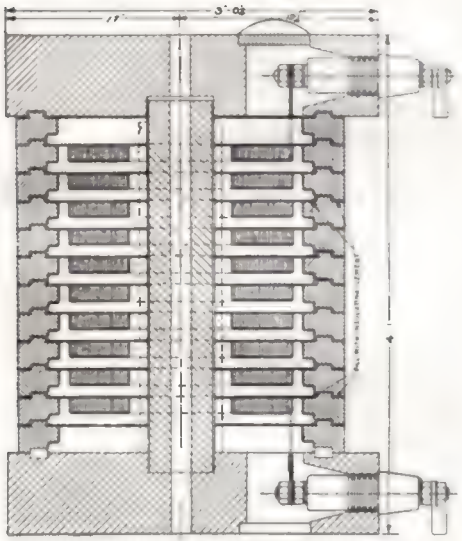
It is held that in all central stations operating high speed turbo alternators the necessity of protective reactance on generators and sections of busbars has become apparent, and the larger central stations have led the way to the solution of this important problem by the extensive adoption of these devices.

It is said that experience has demonstrated to be unfounded the fears of complications or disturbances caused by the reactions upon the operation of switches, underground cables and transmission lines. Protective reactances on the station end of cable feeders have been recommended and are now being introduced in this country.

Undoubtedly the commercial value placed upon the continuity of service must determine the outlay and the extent and degree of protection commercially warranted in any particular locality.

There has been developed reactances to meet the most exacting requirements for the smallest and the largest generators and circuits ranging from 150 kw. to 20,000 kw. and include reactances for large turbo-generators and large transformers, also busbar reactances, and reactances on sections of busbars or tie busses between stations. There are also feeder reactances, for distributing feeders or auxiliary apparatus at stations, and also for small turbo generators in small stations.

The generator reactance coil consists



SECTIONAL VIEW OF A 22 KVA. 25 CYCLE FEEDER REACTANCE

of a series of horizontally wound spirals supported and insulated by porcelain arms, having suitable recesses for the windings. The arms are assembled, radially, as vertical walls between a centre core of concrete or alberene stone and an outer enclosing wall built up of special porcelain segments. These cellular compartments so formed allow natural ventilation for the coil. The whole is supported at the two ends by heavy concrete headers securely held by a number of brass bolts with insulating mica tubes passing through the heads and the wall of special procelain segments from top to bottom. There are ventilating holes placed in correspondence with each vertical cellular compartment of

THREE 280 KVA., 25 CYCLE, 1,750 AMPERE REACTANCE COILS IN SERVICE

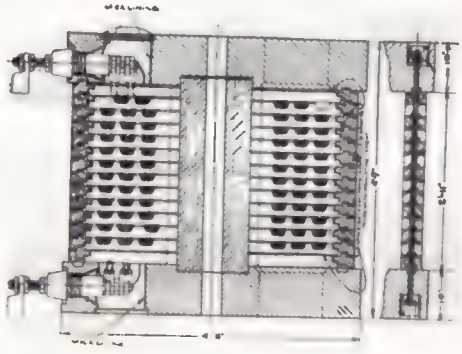
the coil. The winding consists of insulated and specially stranded cables, securely fastened at the ends to terminals passing through porcelain bushings cast into the concrete heads.

The heating is very small and considerably less than the heating allowed for the generators. Each coil is tested at five times the working potential.

It is said that the main standard parts are adaptable to a practically unlimited range of sizes of reactances and by merely changing the number and shape of slots in the radial arms all parts can be used in the construction of coils having single or double conductor windings, a different number of turns in each layer and a smaller or a greater number of layers. By so varying the constants it is possible to meet all conditions of gen-

erators, sections of busbars and voltages and frequencies of systems.

The busbar reactances are made of the same design and construction as the generator reactances by proper change of the number and shape of slots in the radial arms and varying the number of layers in each coil so as to obtain the desired amount of reactance. With a very slight increase in the height for the coil the value of the reactance can be greatly increased. For instance, a 280 kva. 25-cycle reactance is 59 inches in diameter and 55 inches high, while a 304 kva. reactance would be 59 inches in diameter and 67½ inches high, the height of cop-



SECTIONAL VIEW OF A 280 KVA., 25 CYCLE, 1,750 AMP. REACTANCE

per in each case being 30 inches and 42½, respectively.

In the case of feeder reactance the amount of current to be handled is necessarily smaller than in the types of reactances previously mentioned. The coils therefore are of considerably smaller dimensions, both in floor space and in height. The general outer construction is the same as in the larger coils, but the pancake windings are made of insulated copper bands spirally wound. The cotton braid insulation is thoroughly saturated with Petrite and the coil is firmly taped and saturated with Petrite and baked. These coils are placed on the porcelain arms and the successive coils are connected in series.

It may be of interest to note carefully the characteristics of porcelain clad reactances. These developments were the outcome of several years' investigation and experimenting supplemented by practical tests under the most severe operating conditions of central stations.

It will be noted that the coils are porcelain clad and the windings are imbedded at their supports in walls of smooth porcelain insulators. This fireproof and insulating material was selected for its good electrical and mechanical qualities, which are entirely unaffected even by high temperatures. The smooth glazed surfaces of the porcelain also facilitate the inspection and cleaning of the coils. While the selection of material gives a large factor of electrical safety, the almost monolithic construction insures absolute mechanical safety.

It is claimed that the selection of the type of winding, pancake windings in series in place of a drum winding, gives a shorter and squattier coil, a condition essential to reduce flux leakage and therefore obtain the greatest reactance per turn. This series arrangement of pancake windings also produces the minimum potential gradient between any two points of the coil, hence it gives the largest electrical factor of safety.

This feature is of greatest importance in extra high potential reactance, as with the increase in number of turns and the number of layers of pancake coils, the total difference of potential is gradually distributed from the top to the bottom layer, with good insulation between each layer, like in a transformer with different coils in series.

In the case of the stranding used to reduce the Foucault losses in reactances of large amperage this was the result of a minute analysis of the sources of these losses, which were effectually overcome by a simple process of special construction of the cable.

It is clear that the elimination of Foucault losses also made it possible to have the windings insulated throughout with a special insulation, which protects the windings against moisture and foreign objects accidentally falling or being magnetically drawn into the coil.

It will be seen that all these reactances are compact, self-supporting, easily installed, do not require bracing between sets of coils to hold them firmly in place and when in place they do not offer difficulties for their own safeguard. They are therefore eminently suitable for installation in existing stations where the original layout did not provide for the installation of reactances.

SHORT-CIRCUITING AS CAUSE OF FIRE

How little the public in general knows about the nature of electricity is shown by the fact that in the first reports from the place where a fire has taken place, the reporters almost always receive, in reply to their queries as to the cause of the fire, that it was "probably a short-circuit." But closer investigation nearly always proves this assumption to be incorrect.

One of the German official statistical bureaus reports as the causes of fires in one year: 293 electricity, 278 gas, 4,208 petroleum. Handling petroleum is notoriously unsafe. But also gas lighting does not show up well from the point of view of danger, in comparison with electricity, and especially when one considers that the number of electric lamps in Germany is nearly twice that of the gas burners (about 40,000,00 as against 20,000,000). That makes for each gas flame six times as many fires as for each electric lamp. We could hardly expect anything else, when we consider what ordinary common sense suggests —that an unprotected gas flame with a temperature of 2,000° C. is more dangerous than an incandescent electric lamp on which one can hold the naked hand.

Official acknowledgment of the greater danger from gas than from electricity is shown by the fact that in Prussia gas, alcohol, mineral oils and candles are absolutely forbidden for illuminating purposes in theatres and other buildings, especially exposed to danger from fire, and in which a fire would be especially dangerous to human life and limb. Even for emergency lights, only electricity is permissible.

A dangerous short-circuit is almost impossible where the ordinary precautions concerning lighting circuits have been carried out, because the safety devices rob the current at once of all power to do damage, before combustion or fire-catching could take place at the point of short-circuiting.

The few cases of fire which are proved have been caused by electricity have usually been in places where the plant and connections have not been properly installed. A modern illuminating plant is so safe that it would be almost impossible even for an expert to cause a fire by its means.

AN ELECTRIC DRAWBRIDGE

What is missing from the drawbridge shown in the illustration, that is usually present on drawbridges? Anyone familiar with bridges will notice that the smokestack is absent. This is one of the few rural drawbridges in this country that is operated by electricity instead of steam or man power. For a bridge of this kind, electricity has a number of advantages; for instance, it is not necessary to keep up steam for the two or three daily swings, nor is it necessary to have a skilled bridge tender constantly on hand. This particular bridge is tended by a shopkeeper whose place is a few hundred feet away. On hearing a boat's signal, he leaves his work and has ample time to go to the bridge pilot house, turn the controller of the 25 horse power electric motor and have the bridge open by the time the vessel is ready to go through.

The cost of maintenance is very low, also the current, which is used only while the bridge is actually being swung.

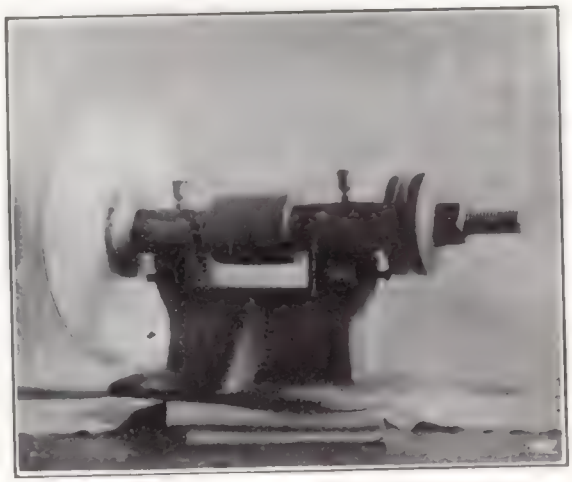
WIRELESS OPERATED BY WIND POWER

The wireless system between the Dutch West India Islands is operated by wind power, and is proving a great success and convenience.

A High Frequency Disc Discharger

By Stanley E. Hyde

THE spark discharger is without doubt the most important piece of apparatus that constitute the closed circuit in radio stations. The closed circuit, that part of the circuit in which are generated high frequency alternating currents, has three components, the inductance coil, condenser and the spark discharger.



Before going into the construction and operation of the spark discharger illustrated in the cut, it will be well to review some of the facts relating to alternating currents, self induction, mutual induction and condensive effects, for if one is not familiar with these subjects he can never hope to understand theoretically the electrical phenomena that take place in such a circuit, for on these principles lies the foundation of radio telegraphy.

Consider Fig. 1. Here we have a conductor with a current flowing in it, away from the observer. The cross represents the tail of a receding arrow to denote the direction of the current in the wire. Whenever a current flows through a conductor it sets up around the conductor an ELECTRO-MAGNETIC FIELD. This field of force, for such it is, as it represents some of the energy of the current, extends out from the center of the wire for some distance and its plane is at right angles to the plane of the wire. We know that this field exists for the reason that we can detect its presence by a compass needle which will try to arrange itself parallel to the field. We say that this field consists of concentric lines of organized force in the ether.

This magnetic field exists only while the current is flowing in the conductor and when the current is stopped the field collapses in upon the wire and returns exactly the same amount of energy that first arose from the wire. The stronger the current flowing through the conductor the stronger will be the field set up around the conductor and the more work it can do. The direction of the lines of force are clock wise when current flows, as in Fig. 1, and counter clockwise when the current is reversed, as in Fig. 2. The point represents the head of an arrow, or an approaching current.

It takes time for a current to build up in a conductor just the same as it takes time for water to rise to full value in a pipe. The time, as far as our senses are concerned, will be practically nil, but it is time just the same, and we must not think that a current flows instantly in an electric circuit, for it does not. It also takes a certain time for the current to fall to zero.

When an electro-magnetic field cuts across a conductor at right angles there will be an E.M.F. set up in the conductor which flows opposite to that in the first conductor from which the magnetic field arose. If the second conductor has its terminals connected a current will flow, but only while the magnetic field is moving across or cutting it. The current in the second conductor is not the same current that was in the first wire, but a different current. But there has been something transferred to the second circuit, and the first must lose accordingly. This shows that the magnetic field that cut the second wire was stored energy in

the ether, for you cannot get something for nothing. Fig. 3 shows the lines of force from the first conductor cutting the second conductor.

If the current in the circuit now be broken the current will die in the circuit and consequently the field will also die, and as it does this it cuts the second wire in the opposite direction, inducing another momentary current. The current in the second wire will exist only while the current in the first rises or falls. Summing all this up very briefly we can say that when a magnetic field cuts a conductor there will be an E.M.F. set up in that conductor.

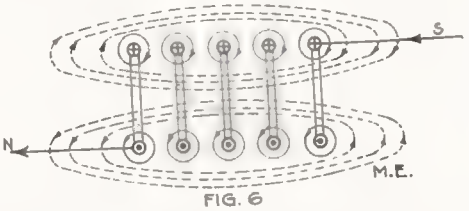
Exactly the same actions take place

when the lines cut the wire that they arise from itself. As they arise from the wire's center they cut the conductor itself and induce an E. M. F. that *tries* to force a current flow in the opposite direction to the original current, but cannot, for the original is the stronger. Nevertheless, its opposition to the original current acts as a resistance to it and holds it back. This is represented in Fig. 4, the large arrow indicating the current flow as it rises in the conductor and the small arrow indicating the back pressure that hinders the current flow. This back pressure is called the E. M. F. of self induction. As the current begins to die in the circuit the magnetic field collapses in upon the conductor and induces another E. M. F. in the opposite direction to the first back E. M. F., or in the *same* direction as the main current flowing in the conductor. This second back E. M. F. tries to keep the current flowing in the wire and thus prolong the time it takes it to fall to zero. This action is indicated by Fig. 5, small arrow being self E. M. F. trying to keep the current going. It is evident then that self induction in a circuit tries to make the current act much slower than would be the case were it not there. As the current rises the self E. M. F. tries to choke it back and as it dies the self E. M. F. tries to keep it going, and it must always be kept in mind that there is self induction acting only while the current changes in value, for when the current in a circuit is once established and flows along evenly the inductive effect ceases because the magnetic field is not cutting the wire.

Where there are no coils or helices in a circuit the inductance is said to be

distributed inductance, but if there be coils in the circuit the inductance is said to be *concentrated inductance.*

In Fig. 6 we have a cross sectional view of a coil of wire and a current entering at the point A. Two currents traveling in the same direction will repel each other, and as the current is always flowing around the coil in the same direction the lines of magnetic force between the turns will cancel each other, but inside and outside the coil will link with each other, the lines from one turn adding their energy to those of its neighbor and continuing this until the end of the coil is reached, this being the north pole of the helix, or solenoid, as it is sometimes called. They then turn back and come in at the south pole. Choke coils are built in this manner so that there will be a large self E. M. F. to hold back too



much current from flowing in a circuit. It will be readily seen that on a direct current where the current is flowing steady there would be no self induction because the magnetic field around the coil is not cutting the respective turns and inducing currents in them, but on alternating currents where the current is periodically rising and falling in value there will be considerable back pressure developed. So when we have an inductance coil in a circuit we are making the circuit electrically longer, so to speak, for to ob-

tain the same effect where the inductance was distributed it would be necessary to make the conductors composing the circuit many hundreds of feet long.

Referring again to Fig. 3 where energy has been transferred to the second conductor, B, from that of A, we find that the current set up in B will also set up around itself a field, and

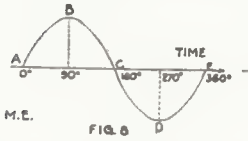


FIG. 8

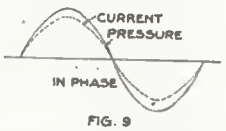


FIG. 9

the lines of force will reach out and cut A, producing a pressure in the same direction as the original current in A. See Fig. 3A. This tends to make more current flow in A. A good example of this reaction which occurs in two circuits of this character and which is termed MUTUAL INDUCTION, is that which takes place in a transformer. You probably know that when you have no load on the secondary of your transformer that the primary draws very little current, but if the secondary be short circuited or a heavy load such as a large condenser be put on, the primary will immediately begin to pull current. This mutual induction also acts in the oscillation transformer and effects the purity of the wave sent out. This will be enlarged upon as we proceed.

An alternating current is a current, as its name implies, that alternates first one way and then the other. It rises to a maximum, AB, Fig. 8, falls to zero at C, reverses its direction,

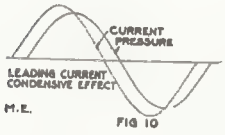


FIG 10

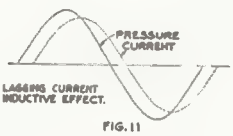


FIG. 11

rises to a maximum in the opposite direction and falls to zero again, completing what is called a cycle. From A to C is a half cycle or alternation, thus two alternations make a complete cycle. Fig. 8 represents the alternating current graphically, a cycle being equal to 360 degrees. It is called a sine curve. The current reaches a maximum when it reaches the highest part of the curve at B, then it begins to fall in value till it reaches C, where the value is zero. C is termed a node, or neutral place in the wave. The straight line, AE, is reckoned as time.

In studying alternating currents graphically we have two curves to deal with, the pressure curve and the current curve. We mentioned before that when inductance was in a circuit it tried to hold back the current, so in an alternating circuit where inductance is present the current will lag behind the voltage or pressure, and the number of degrees it will lag depends on the amount of inductance and capacity in the circuit.

If a condenser be inserted in an alternating circuit it will have the effect of making the current go ahead or lead the pressure, just the opposite effect from that of an inductive circuit.*

When the inductance and capacity in a circuit are evenly balanced the current and pressure are said to be in PHASE with one another; i. e., they rise and fall in value at the same instants. This is represented in Fig. 9. In a condensive circuit, one where

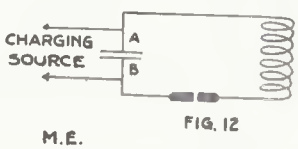


FIG. 12

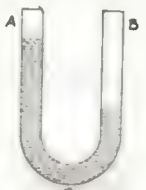


FIG. 13

there is more capacity than inductance, the current will lead the pressure as explained above, this being represented in Fig. 10. The number of degrees that the E. M. F. lags behind the current is called the PHASE DIFFERENCE or angular displacement, and the cosine of the angle represented by this number of degrees is called the POWER FACTOR. Wave shapes for an inductive circuit, where there is more self induction than capacity, are shown in Fig. 11.

Summing up facts about inductance and capacity in alternating current circuits we come to the conclusion that inductance hinders the current while capacity assists it. By combining these two factors we can, in a closed circuit such as Fig. 12, either make the

*For discussion on condensers see page 18, April issue.

current rise and fall slowly or very fast, to suit the occasion.

If an alternating current has a frequency of from 50 to 100 cycles it is referred to as a low frequency alternating current. If, however, the frequency were of the order of 1000, 10,000, or 100,000, it would be described as a high frequency alternating current. When the frequency arises to a value of a million or so the current is generally called an electric oscillation.

In radiotelegraphy we are chiefly concerned with high frequency currents or electric oscillations of a frequency of

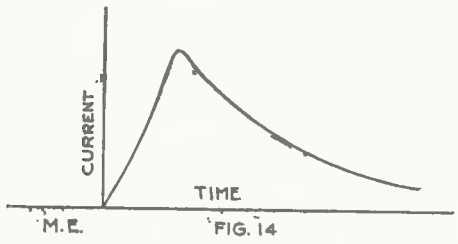


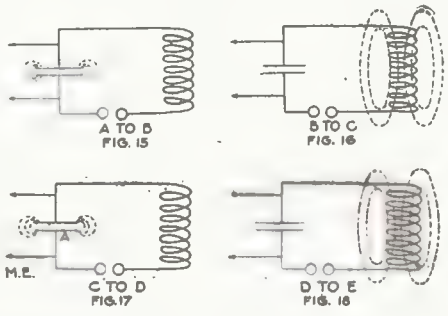
FIG. 14

100,000 and up to a million or more.

We will now dwell upon the closed circuit, beginning with the condenser.

The closed oscillation circuit consists of a capacity, an inductance and a spark discharger. There is no need to describe the two former. What is a spark gap, and what is it for? The spark gap is merely an automatic switch and is used to open and close the closed circuit at the right time. See Fig. 12. To the terminals of the condenser, A and B, is connected a source of high potential alternating current to charge the condenser. While the condenser is charging it is the function of the gap to insulate as perfectly as possible, so that none of the energy being charged into the condenser will leak around through the rest of the circuit and thereby cause a loss in power. And, on the other hand, when the condenser has been fully charged and is ready to discharge the gap must conduct as perfectly as possible to minimize losses in resistance at the gap. In reference to the gap as an automatic switch again, while the condenser is charging the switch should be open and while discharging it should be closed.

Where there is considerable resistance in a closed circuit the condenser discharge will not be oscillatory in character, but will be of a "Dead Beat" nature, as shown in Fig. 14. The condenser will charge to a maximum and then, due to the resistance in the circuit that chokes back any oscillations that might be formed, will gradually leak through the circuit until the condenser is discharged. This action can be more clearly seen by referring to a simple water analogy, as represented in Fig. 13. Consider a U-tube ABC. In this tube is water. If now the water is drawn up into the part, A, and suddenly let go, it will immediately fall and rise in the part, B, and it will rise a little above the normal level of the water on account of its inertia. The water will keep up this rising and falling until its motion is used in overcoming the resistance of the sides of the tube to the water, each swing decreasing at a certain ratio to the preceding swing. Suppose we put some heavy sand at the bottom of the tube, C, and start the water to falling again. It will fall until it strikes the resistance of the sand and this will keep it from immediately rising in B. Finally it will gradually trickle through the sand over to B, but there has been no rising and falling motion of the water on account of the resistance to its motion. This is exactly analogous to what happens in the closed circuit when resistance is introduced in the form of small leads to and from the condenser and inductance,



small wire composing the inductance and poor gap, of which we will speak more fully later on.

In Figs. 15, 16, 17, 18 are represented the four different periods in the closed circuit that compose one cycle. Keeping in mind the sine curve of Fig. 8, turn to Fig. 15. Here the current from the step-up transformer is beginning to charge the condenser, hence all the en-

ergy is condensive or stored energy. A to B, sine curve. It takes a given time for the condenser to charge. The charging continues until the pressure developed in it is sufficient to break down the resistance of the spark gap. Before the gap has been ruptured its resistance is approximately 25,000 volts to the inch, i. e., it takes 25,000 volts to break down a gap of one inch. But as soon as the gap has been passed by the first discharge the resistance drops to a few ohms or less and the current passes through the inductance, setting up lines of force that cut the turns of the inductance and induce a

FIG. 19 FIG. 20

self induction E. M. F. that tries to hold the current back, as explained in the section on self induction. As this magnetic field is set up around the inductance the energy is all magnetic, Fig. 16, this represents from B to C on the curve. It shows the condenser charge falling in value as it discharges through the inductance. As soon as the gap is broken down the magnetic field begins to collapse in upon the inductance and induces a current that flows in the same direction as it did when the condenser was discharging. This passes across the gap and into the plate, A, Fig. 17, charging the con-

FIG. 21 FIG. 21-A

denser again in the opposite direction. Again some of the energy is condensive, but not all, because some of it has been dissipated in the form of heat and light at the gap and in overcoming resistance of the circuit. Condenser charging again in the opposite directon on curve from C to D. Again the condenser discharges through the inductance and across the gap, this last being again for the second time energy in the form of a magnetic field around the inductance. Thus the cycle is completed, consisting of energy in a condensive form twice and in a magnetic form twice. Last discharge on curve from D to E. Fig. 18.

Very large conductors should be used in connecting up the closed circuits for the reason that high frequency currents reside on the surfaces of conductors.*

It must be remembered that the actions taking place in the closed circuit happen in an infinitesimal part of a second, and a million of these cycles, as outlined above, may oscillate back and forth in the circuit in one second, until they are gradually damped out by resistance and a poor spark discharger. Each of these oscillatory condenser discharges is called a WAVE TRAIN and the frequency of the oscillations composing them depends on the values of the inductance and capacity.

The frequency, or number of cycles per second, of any closed circuit made up of an inductance and a capacity can be found by the following equation, which is known as the fundamental equation of radio telegraphy:

$$f = \frac{I}{2\pi\sqrt{L \times C}},$$

where f is the number of cycles per

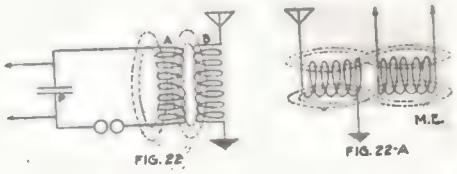


FIG. 22 FIG. 22-A

second; L, the inductance in henries, and C, the capacity in far

The number of wave trains will depend on the frequency of the alternating current dynamo that is employed, and as there are two condenser discharges or wave trains for every cycle, and if, for instance, we hear a 500 cycle quenched spark set we are hearing 1000 wave trains per second, but this is not saying how many oscillations or cycles make up each wave train, this depending, as mentioned above, on the values of the inductance and capacity and upon nothing else. Fig. 19 shows three wave trains composed of gradually decreasing wave crests, although there may be 100,000 or more of them in each wave train, or condenser discharge. Fig. 20 represents two cycles in the

*See Jan., 1913, issue, page 1037, for an article on high frequency resistance.

wave train. The distance between two wave crests, W, is the wave length of the oscillations. The distance, A, from the top of a wave crest to the bottom or hollow of the falling oscillation is termed the amplitude of the wave, and the ratio at which the amplitudes of the succeeding oscillations differ is known as the Decrement. In the Radio Law it states that that the Logarithmic

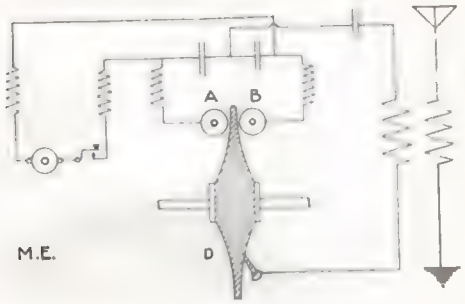


FIG.23

Decrement per cycle shall not exceed two-tenths. See Fig. 21. The Amplitude of the wave crest, B, shall be at least 0.82 that of the amplitude of A or the Logarithmic Decrement will exceed 0.2.* Similar is the case with C and D. If it is less than this the tuning is not sharp and the radiations from the transmitting station will not travel very far, as they have nothing to back them up. This is why the Poulsen System can do such excellent work overland, in that their oscillations which compose the wave trains are practically undamped, Fig. 21A, and do not die out quickly.

Now we come to Mutual Induction in the oscillation transformer and this is what effects the purity of the wave sent out—i. e., whether there is a main wave with a smaller wave superimposed upon it or not.

Let us take the circuit of Fig. 18 and add another coil close to the one already in the circuit, Fig. 22. Now we have an oscillation transformer, A and B. Assume that the lines of force composing the field around the coil, A, are rising and cutting the coil, B. The current wave set up in B will be the natural wave length of the closed circuit, which we will say to be 500 meters (it is assumed that the two circuits are exactly in tune with each other). In turn as the induced currents are set up in B, they will create a magnetic field around B that will reach out and cut A, the original current in A in the meanwhile having all nearly passed across the gap. Thinking of the gap as an automatic switch again we see that as the gap has not opened up as it should on account of gasses which make it more or less conductive, that there will be a current wave superimposed upon the tail of the receding current that flowed through the inductance, A, and which now is passed across the gap. By this action there are two waves sent out on account of this mutual induction between the two coils and the poor action of the spark gap. If the conductivity of the gap had been broken at the exact instant after the condenser had discharged through the inductance, A, the little current wave sent out from B would not have been superimposed upon the discharging condenser current because the latter would have already passed across the gap and into the plate, P, and as the conducting gases are not present the superimposed wave could not follow it, for it has not enough energy to break down the resistance of the gap by itself. Fig. 22A illustrates this reaction between

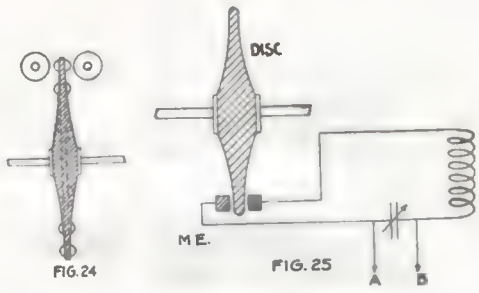


FIG.24 FIG. 25

the two coils of the oscillation transformer.

The first Rotating spark gap was used by Marconi for the purpose of producing slightly damped waves, but the waves followed each other with such rapidity that it necessitated the use of a Tikker. The connections for this Disc Discharger, as it was called, are shown in Fig. 23. The disc, D, was rotated at a very high speed and was supplied, in conjunction with the condensers, direct current at a potential

(*Continued on page* 352)

*See p. 922, Dec., 1912, issue.

A Mysterious Electric Illusion Box

By Frank C. Perkins

ANY device which is operated electrically and is in any way mysterious or works automatically and continuously is of great interest to the boy or girl and usually attracts the attention of the adult without difficulty. A mechanical or electrical toy has a peculiar fascination for a youth of a technical turn of mind and any device in the form of an allusion or suggesting "Magic," "Sleight of Hand" or "Conjuring" is eagerly sought by young people.

In the window display magic electric box an automatic thermostat is utilized with electric lamps so arranged that an aquarium apparently without fish at one moment is seen in top box Fig. 2, and in the next instant is seen swarming with live gold fish. An

FIG. 1

empty cage viewed through the opening in the box as noted above in Fig. 3 suddenly has a handsome canary singing and in full view, or an empty cigar box at one moment, is instantly filled with cigars before the observer's eyes the next instant as indicated in the lower magic box of these illustrations.

It is well known that many times heretofore these optical illusion effects have been produced in different ways and on a larger scale at theatrical performances and other amusement places by sleight of hand performers, but this unique electrical device has been so constructed that any boy or girl may produce the same marvelous effects in the family parlor, or a merchant may utilize it as a store window attraction for displaying jewelry, shoes, novelties or other goods in an attractive and startling manner; the details of construction which are simple and the method of operation of this invention being given below in detail, showing how these wonderful optical illusion effects may be produced.

The upper magic box is about 12 inches square and about 8½ inches high for parlor magic service or for jewelers' window display, while the other box is 18 inches square and 10½ inches high for use in large window displays, and still others are constructed large enough for entertainments where a boy sitting on a stool appears to turn into a girl or disappears entirely from view.

It may be stated that the front wall is made in one piece but the rear and side walls are each constructed in two normally overlapping pieces to permit of opening the casing at the right side adjacent to the front right corner and at the rear adjacent to the rear left corner.

There is a partition arranged diagonally within the casing the full height and extending from the front left corner to the right rear corner which divides the casing into front and rear compartments. The left half of the partition opposite the sight opening of the casing is transparent and the right half opposite the front wall section is opaque. The transparent part of the partition consists of glass; the vertical groove formed on the left edge of the opaque portion receiving the inner op-

posite edge of the glass partition section.

The interior of the casing and also the opaque part of the partition are rendered non-reflecting by making the same of black or dark dull material such as charcoal iron or by producing

FIG. 2

a dark oxidized copper finish to prevent reflection of light.

For operating this device with little or no expense it will be noted that adjacent to the rear or right end of the partition the right wall has an opening and the rear wall has an opening which lead from the exterior into the front and rear compartments, respectively. This permits of inserting by hand a match, taper, candle magnesium wire flame or other light into these compartments or withdrawing the same for the purpose of either illuminating these compartments or darkening the same, thus doing away with the electric lamps, thermostat, and connections; the latter, however, producing the best results.

For operating this magic box by electricity the top of the casing is also provided, adjacent to the right or rear end of the partition, with two openings which lead into the front and rear compartments. Detachably secured in these upper openings and arranged in the front and rear compartments, respectively, are two incandescent electric lamps whereby these compartments may be illuminated.

It will be seen that upon placng an object in one or the other of the compartments in the casing within range of the glass part of the partition and alternately illuminating the compartments, there will be produced the illusion, or looking into the casing through the sight opening, of the object appearing and disappearing.

When the rear compartment only is illuminated any object arranged within the same in rear of the glass part of the partition is visible to the spectator looking into the casing through the sight opening. When the front compartment only is illuminated, however, and the rear compartment is dark, any article in rear of the glass partition is obscured and any article in the front compartment is reflected by the front side of the glass partition in the line of vision of the spectator at the sight opening and is made to appear as if located behind the glass partition.

In case an empty bowl or aquarium is arranged in the rear compartment and a bowl or aquarium of like character containing fish is arranged in the front compartment at the right, upon illuminating the compartments alternately it will appear to the observer at the sight opening that a fish is alternately present and absent from the

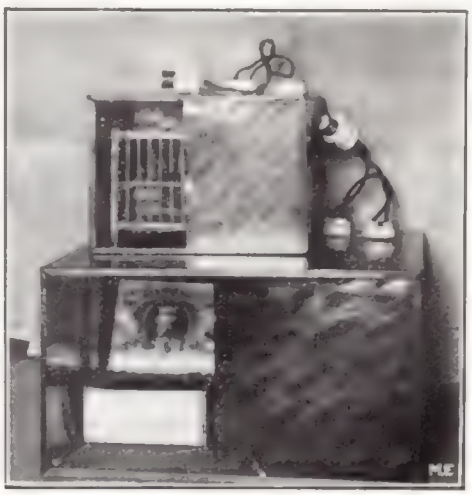


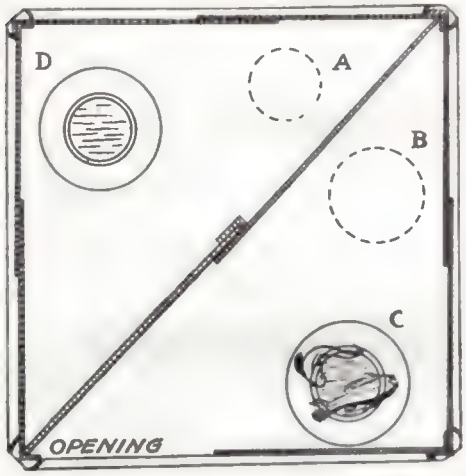
FIG. 3

same bowl as noted in Fig. 2. A like illusion can be produced by the use of two vases arranged in the respective compartments, one containing

flowers and the other empty as noted in Fig. 1, the flower seemingly appearing and disappearing from the same vase as the compartments are illuminated alternately.

If desired the left part of the rear wall behind the glass and the front part of the right wall may be withdrawn and the faces of different persons may be placed therein with a curtain hiding the box excepting the opening, in which case alternate illumination of the compartments produces the impression to the persons gazing in the sight opening of the faces (of the persons at the side and rear openings of the casing) changing from one to the other at the same place.

Instead of placing faces at the openings in the casings within range of the glass part of the partition, any article may be placed there and be made to appear and disappear, or a skull may be used in one opening and the flesh



SECTIONAL VIEW OF BOX

will appear to leave the bones or reappear on the grinning skull at will.

When used in the above described manner, this illustration device serves as toy or magic box for amusement and entertainment but when it is desired to use the same for advertising purposes, as for instance in the store window, the price and description of an article may be placed in one compartment and the articles referred to in the other compartment within range of the glass part of the partition; the description and article apparently appearing and disappearing in view of the spectator as the compartments are lighted alternately.

In case electric lamps are employed for illuminating the compartments the operation of same may be controlled by various means to produce different effects. For instance, the lamps may be connected in parallel and each turned on or off by means of a hand operated switch or the button on the lamp socket, or if desired, a hand operated adjustable resistance may be included in the circuit of each lamp in order to produce a gradual fading away of the object or its reappearance.

The lamps may be turned on and off automatically in various ways instead of by hand, for instance, the lamp may be connected in series to a thermostatic switch plug provided with a heating coil which operates to automatically open and close the circuit through the respective lamp. One being of high candle and the other of low candle-power and from a point between these lamps a short circuit extended to the side of the lighting circuit, which connects with one lamp; this short circut containing a thermostatic switch. When the contacts of the switch plug are closed the small lamp is short-circuited allowing the high candle-power lamp to burn at full brilliancy. When this switch is opened, the two lamps operate in series relatively to the lighting circuit, causing the low candle-power lamp to burn with increasing brilliancy and the high candle-power to be reduced to a dull red glow on account of the high resistance of the low candle-power lamp being thrown in series with it.

When the alternate lighting of the compartments is effected quickly and automatically and continuously the change in appearance of the object in the casing also occurs quickly and may be adjusted from a few seconds to a half minute apart. When the light in one compartment is diminished gradually while the light in the other compartment is increased in the same measure, the object in the former gradually disappears or fades away while that in the latter gradually becomes more distinct, beginning with a phantom-like image and gradually growing clearer until the complete transformation has been effected.

The Antenna

By B. N. Burglund

THE antenna or aerial is one of the most important parts of a first-class wireless set, and no matter how efficient the rest of the apparatus may be, unless you have an efficient and properly designed antenna your set will not work up to its best efficiency.

In designing an antenna two points must always be kept in mind;—first, low resistance; second, insulation. Both are equally important. The first, if ohmic resistance is too high, the damping will be great and consequently a broad wave, with very little radiating power; the second, if insulation is not looked after, the outgoing currents will all be dissipated before they can perform their proper usefulness, and the delicate incoming signals will all be lost long before they reach the telephone receivers.

Another very important factor which most amateurs overlook, is the proper spacing of the wires in their antenna. The spacing of the wires in any antenna depends entirely on the length of the antenna and the wave transmitted.

The wires should never be allowed to come closer than 1/50 of the total length of the antenna. The more wires in the antenna proper the greater the radiation, provided they are not too close together.

Let us imagine we can see the current leave the transmitting set and follow it on its course up the aerial.

As the current follows "Ohm's" law and also has other peculiar properties of its own, such as not wishing to turn sharp corners; but would rather leave the antenna and go wandering off to ground at the first sharp turn unless proper smoothed out paths are provided for it. Now the current is not the same in all parts of the antenna. Near the helix, or, rather its source, the current is very heavy and the voltage is comparatively low; but as the current travels along the wires the voltage rises and the current drops off, consequently at the farthest end from the instruments the voltage is highest and there is practically no current, so that at this point we must have the very best of insulation,—insulation that will withstand enormous voltage under all kinds of atmospheric conditions,—rain, sleet and wet snow.

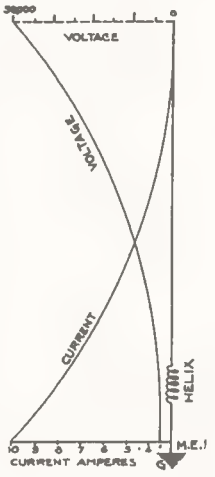


Fig. 1 shows how the current and voltage are related to each other in a wire which is in tune with a transmitter.

Now let us start over again and remember we have more than one wire to carry the current say six wires spaced two feet apart and our antenna is 300 feet long.

Now there is another very important electrical law which comes into action here beautifully and that is:—like currents repell each other and unlike currents attract each other. Therefore, as the current leaves the transmitter, passing out over the lead-in wires and the antenna proper, the bulk of the current takes the two extreme outside wires and very little current flows in the inner wires. In that part of the antenna where the voltage is low this is not so marked; but as the voltage rises this phenomenon is more and more marked, until near the end of the antenna no current at all exists in the center wires.

Now experimenting has proven that in order to make the current travel in all the wires efficiently they must be spaced so that the inductive effect is as little as possible between the individual wires, and a generally accepted rule is not to bring the wires closer than 1/50 of their total length. This is conservative. Personally I space them much farther apart

where possible, especially at the distant end.

In order to bring these points out clearly to the minds of the experimenters, I am going to describe in detail two kinds of antenna, and show the results obtained by each. This example was a ship where conditions were somewhat limited for ideal construction, but it is an excellent example to clearly show how important a factor proper antenna construction is for efficient long distance work. The antenna which I am describing is in actual operation on board the U. S. S. *Dorothea,* stationed at Cleveland, Ohio. Her call letters are NES.

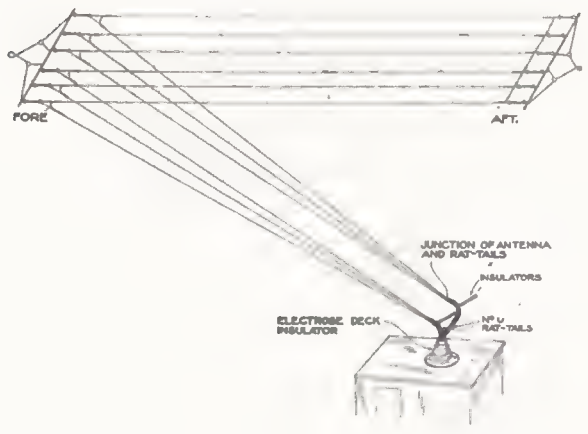


FIG. 2

Her two masts are approximately 100 feet high and 100 feet apart.

Owing to the short distance between spars I designed this antenna on the tipped over V type, or, more technically speaking, inverted L type. Fig. 2 shows the possition of spars and operating room (wireless); the spreaders are made of pine well finished and spar varnished. The one on the main mast is 18 feet long and the one on the foremast is 14 feet long. The bridles which support the spreaders are made of 12 thread "ratline," that is, a rope made of tarred hemp. This bridle was made according to Fig. 3 and is very good construction. The insulators are of hard rubber one inch in diameter and 12 inches long, fastened to the spreaders with short pieces of copper wire.

This type of insulator is very easy to construct and is not as liable to cause trouble in continuous service as electrose or porcelain. Before we go further I will describe in detail how to make these insulators.

Procure from any rubber supply store hard rubber rod one inch diameter and have it cut into 12 inch lengths, as many as needed. In the case of U. S. S. *Dorothea* I used 14 insulators. Next procure from any hardware dealer two screw eyes for each insulator about 1½ inches long by 1 inch eye. These should have a taper thread for screwing into wood. Drill a hole in each end of the hard rubber rods, slightly smaller than the narrow part of the thread of the screw eyes. If you are handy to the kitchen stove, put on a kettle of water and place the ends of the hard rubber rods into this and bring the water up to a boil. Let the water boil and drop the screw eyes into the water and let them get hot also. Now get a towel and a good pair of gas pliers, also a little grease. With the gas pliers take out of the boiling water a screw eye, dip the end slightly in the grease and with the other hand and a dry towel hold the hard rubber rod and screw the screw eye home. You will be surprised how easy the eye goes into the rubber. Now chill the rubber quickly in ice cold water, leave it there for a few minutes, and when taken out you will find the screw eye firmly imbedded in the hard rubber and on a constant pull the screw eye will hold as much as 500 to 700 pounds, and that is as much as the wire will stand. I have made a good many hundred insulators in this manner and never had a single screw eye pull out. The wire or rubber will break first. Finish the rest of the hard rubber rods in the same manner and it is well, just before hoisting up the aerial, to smear the insulators well with vaseline. This keeps the weather and rain off.

Now back to our aerial again. We spaced our insulators equally on each spreader, six on each of them. The antenna wire used is seven strand No. 20 phosphor bronze. All wires were measured off the same length on the

deck, then cut and marked so that when they were fastened to the spreaders and hoisted aloft they were all equal in length. This is better practice than trying to adjust the wires afterward.

The wires on the main mast spreader are all tied together with what we call the jumper, and you will notice no sharp corners are exposed, but small bends are provided around the corners. On the foremast the wires are not tied together, but continue down to the deck insulators in two groups of three wires each, where they are soldered to two No. 4 rattails which lead into the operating room and the transmitting set through the anchor gaps.

This type of aerial is very short and broad, wires spaced the proper distance apart and the ohmic resistance is very low, less than two ohms. Consequently radiation is very good. The antenna used before this one was 4 wires on 8-foot spreaders with the high tension end on the foremast. The leads were only two wires running straight up the main mast parallel to other wires running up to the signal lights. This type of antenna was wrong in design. In the

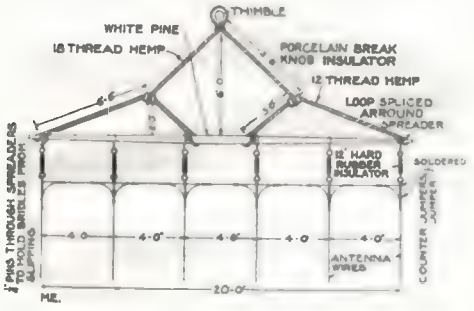


FIG. 3

first place too long and narrow; in the second place, the lead-in wires had too much resistance where the current was heaviest; third, the lead-in wires were parallel with other wires where most of the energy was dissipated in induction before it reached the flat top.

With the new antenna I could work easily over 200 miles in broad daylight, while with the old antenna it was impossible to work over 30 miles, even in the best of weather conditions, in each case using the same transmitting set. Now 200 miles over fresh water in the daytime is extraordinary work, even for an antenna three times this height and size.

Now a word in conclusion. This type of antenna can be followed out by the majority of experimenters and the main points be kept in mind; and a good deal better results can be had than by an antenna of wrong design. It is not necessary to buy polished hard rubber rod,—rough second-grade rubber answers equally as well and is a good deal cheaper. In fact, my insulators cost me about 12 cents each and are much better than more expensive kinds costing three times as much. Do not be afraid to use solder and plenty of it. It pays in the long run.

When this antenna is transmitting a gentle brush can be seen from the high-tension end, extending towards the foremast, on all six wires. This is a good indication that the antenna is resonating properly and is not a defect, as some writers have stated, but a natural consequence of the phenomena of resonance.

INSTITUTE OF RADIO ENGINEERS

At the meeting on May 8th, Dr. A. E. Kennelly delivered an exceptionally interesting paper on the "Daylight Effect in Radio Telegraphy," covering the general theory of radio transmission between earthed conductors, and the probable causes of attenuation and of the rapid variations in signal intensity which occur near times of sunrise and sunset. The meeting was very well attended, and a discussion, in which representatives of nearly all radio and wire communication interests took part, followed the address. The opinion held by all was that great credit was due to Dr. Kennelly for explanations which are so well sustained by observed facts of the absorption phenomena.

At the June 4th meeting, which occurs while this issue of the magazine is on the presses, Mr. John L. Hogan, Jr., of the National Electric Signaling Co., is scheduled to present a paper describing the new "Heterodyne" receiver as used in the Fessenden system during the recent trials of the Arlington Naval radio station.

Electricity Brings Money From the Garbage Can

By Felix J. Koch

OF course if your wife is a provident housekeeper, she cooks just enough to suffice and no more, and there is little or nothing that goes to waste, but even so, there are the peelings of the potatoes, the tops of the turnips, the husks of the corn and the bones of the chicken which go to the garbage can. It probably never occurred to you that there was value in this refuse, nor did it to many another, until the electro-magnet was set to work on the mass and finally other electric devices applied.

The story, with its prelude of what must occur first to the garbage, is an interesting one.

Ever so often the city street cleaning department sends a van about to collect this offal, as if garbage were a recognized part of street cleaning, and it collects the refuse as it would any other mass in the streets. Once it has left your door, that ends it—so far as you care. Whence, though, goes the garbage?

How many readers know that the big cities to-day often get enough to support a school or a couple of playgrounds and the like, or even run a park from just this garbage?

The dollar bill in the garbage can is a matter of recent birth. It isn't so terribly long ago—less than a decade—when even New York City used to take all this waste and offal of the metropolis in city barges and bear it out a certain distance to sea, where, with a deftness borne of long practice, they dumped it into the ocean. Then, in due time, if the winds were bad and the sea were cruel, if you were bathing down at Atlantic City you would suddenly find a delightful selection of cabbage leaves and putrid tomatoes surrounding you, or there came a small floating island of old paper and bits of food, broken up fruit baskets, etc., and, resting on this, like some Crusoe on his raft, any other thing a householder might toss away.

Now all this is changed. Your garbage wagon bears its no longer useless burden out to a sort of crematory, as it were, sometimes run by the city, and at other times operated by private enterprise, which pays the city so much per wagonload for the garbage, or at times assumes the cost of the collection in return for the receipt of the garbage. That, then, saves the city the cost of wagon and horses, wages of collectors, and so on.

The Germans, though, were the first to find that electricity could put additional value to this garbage.

Over in Hamburg the garbage and house refuse are collected and carted to an incinerating plant which is regarded as a model of its kind and which has given perfect satisfaction during the sixteen odd years of its use. To this place the refuse has been conveyed in water-tight iron carts, four wheeled, and each of them of capacity of about 4 cubic meters. The cart bodies can be lifted from the wheels by means of electric traveling cranes, and the contents are then discharged directly into the furnace.

Once the fires have been started they support themselves, much as do the "try-works" of a Labrador whaler, where the chunks of oil-soaked meal keep the fires up to the end of melting the blubber. The consumption of coal therefore is insignificant.

The "slag," as it is called, is then "removed" from the furnaces in small iron carts and conveyed by means of these to a cooling apparatus.

There the contents are then sprinkled with cold water and pass on to what are known as "slag-breakers." These are arranged to produce broken slag in three sizes. Some 16 per cent. is broken so as to pass through a screen of 1/5 inch mesh. Then 50 per cent. of the whole is to pass through a one inch mesh, and the balance is so crushed as to go through a 2.4 inch mesh.

What is more, an electro-magnet is in operation in connection with the

slag-breakers and it removes small pieces of iron which may be found. Insignificant as these might seem, housemaids and scullions are careless; things will be thrown away, and so these form a by-product which in large cities totals no small sum. Larger pieces have been removed from the refuse before it enters the furnace, or else, if found in the slag, they are thrown out of the rotary sieve-drum at the lower end of the breaker.

The investigator for the American Government, taking up this matter, tells us how the iron so recovered is sold at public auction. Even the slag is sold, but at a fixed price of 23.8 cents per ton of 2,200 pounds.

To what extent all this has been developed is really surprising. "The garbage incinerating furnaces," Mr. Skinner advises, "furnish sufficient power to drive all the electrical machinery in the establishment, to operate the crane, slag-breakers and the light plant, as well as furnish electricity for the accumulators of an electric motor launch and an electric motor car used in the transportation of garbage.

"Bye and bye horses will be eliminated entirely in the handling of the garbage as a result of this power derived from itself." Then we will find that electricity will bring enough dollars from the garbage barrel to pay for collection and making into fertilizer this waste, and leave the iron which it recovers as pin money for those who have this rather unique public service in their charge.

ELECTRIC MINE TRAINS

Mules, horses and donkeys, from time immemorial used to haul mine cars, especially in coal mines, are now being rapidly replaced by electric mine locomotives such as the one shown with train of cars, in the accompanying illustration. The reason for this change is not only the increasing cost of the animals, and the decreasing cost of electrical equipment and current, but the great power that late types of these little locomotives can develop, and the number of cars they can handle. When an electric locomotive is put in service in a mine, it usually takes the place of 10 to 15 animals, and the men or boys required to drive them. Another reason for the increasing use of electric locomotives in coal mines is that direct-current motors used in them have been so perfected that there is no sparking at the commutator which has heretofore been a source of danger on account of the inflammable gases usually found in coal mines.

Electric mine locomotives are made for tracks as narrow as 18 inches, and

for mine channels having head room of only four feet above the tracks. They usually operate on 550 volts, direct current.

CHESTER HILL RADIO ASSOCIATION

The Chester Hill Radio Association, of Mount Vernon, N. Y., has formed a new club of which the following officers were elected: Waller V. Morgan, president; Richard D. Zucker, secretary and treasurer.

The club contains but few members at present, but hopes to add more in the near future, and would be glad to talk to all amateurs within our radius. The Club call is CHR.

Charter members: W. E. Emeis, R. K. Karlowa, W. E. Berwald, Russell Thomson, G. Wunder, Fred Clawe, Elmer Jens, W. L. Prager, Hugo Martens, Julius Helpenstel, Arthur Miller, Willie Culley, Kenneth Oak, George McDonald, Lawrence Johnson, Marvin McNeill, R. W. Toenniges, Neil McNeil, Herbert Copp.

HOW AN ELECTRICAL COIN IN THE SLOT PHOTOGRAPH MACHINE WORKS

Many of our readers no doubt are familiar with the automatic machine which will deliver a finished photograph of the sitter within a minute or so after a coin has been deposited in

FIG. 1

the slot of the machine. While the machines are very much in evidence at amusement resorts and similar places, as a rule, one has little opportunity to see the mechanism or to find out how they work.

Through the courtesy of Mr. F. M. Hoblitt we are able to present illustrations of the mechanism of the "Photo Machine" and explain its operation.

Fig. 1 shows the external appearance of the machine in operation. Fig. 2 shows the mechanism, and Fig. 3, the wiring diagram.

With the exception of the chemical treatment necessary in developing the picture, the entire process is a mechanical one, and is controlled through the mechanism shown in Fig. 2, which is driven by a small AC or DC motor about 1/60 of a horse power.

With the exception of the plate magazine, the water tank, the tank for the developer and a third tank to receive the waste water and chemicals, the entire mechanism is shown in Fig. 2. The water tank is at the top of the machine, the waste tank at the bottom and the tank containing the developer is on the

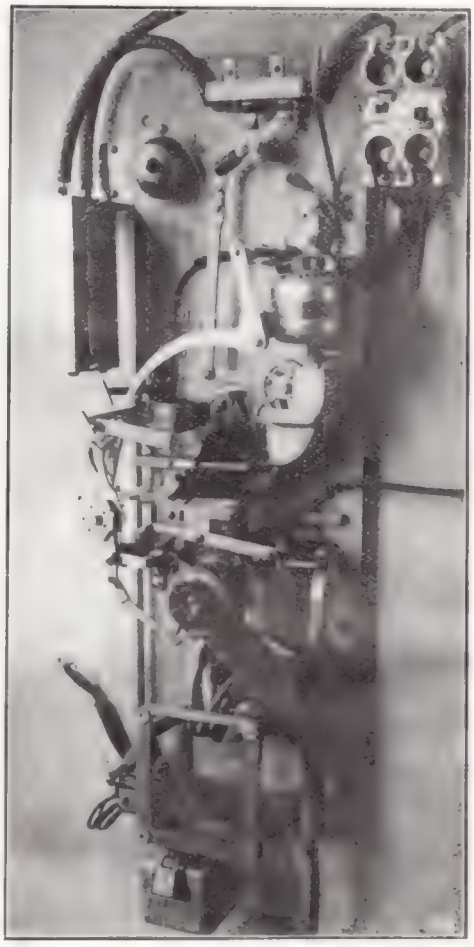


FIG. 2

right side, and is not visible in the photograph.

When the coin is pushed into the slot it drops through a chute which guides it between two springs at the bottom of the mechanism. These springs form the terminals of the motor circuit and the coin bridging the space between these two springs com-

pletes the motor circuit and the motor starts. The coin remains in this position until the photograph is delivered. The motor, the speed of which is controlled by a suitable governor, drives, through suitable gearing, a cen-

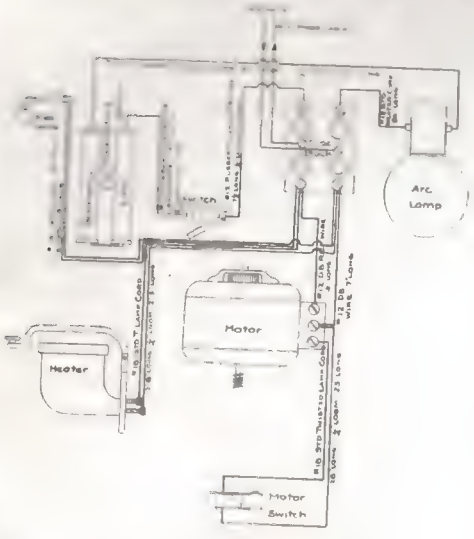


FIG. 3

tral revolving arm which has at its outer end a sort of crank pin which operates a series of levers arranged around the circumference of the path traveled over by the pin.

When the motor starts, the arc lamp circuit is closed and the revolving arm moves a lever which releases a plate from a light tight magazine and drops it into the camera, where it is held in the focal plane of the lens by an automatic device. In the meantime the arc lamp has settled down to steady operation and the revolving arm moves a second lever which opens the camera shutter and makes the exposure, which is adjustable as to length. As soon as the exposure is complete a bell rings to notify the sitter that the picture has been taken, and the arc lamp is extinguished. As soon as the exposure is completed the lever which holds the plate in position is released by the revolving arm and the plate drops from the camera into the developing tank. As soon as it reaches the tank the revolving arm moves a third lever, which dumps about a teaspoonful of developer onto the picture. As soon as the picture is developed the arm moves a fourth lever, which turns a stream of water into the developing tank.

In about 40 seconds from the time the plate lands in the tank it is completely washed and the revolving arm moves a final lever, which discharges the plate into the chute which delivers the finished picture to the sitter. At the same time this lever pushes the coin from between the contact springs, whence it drops into the coin receptacle and the motor stops. This completes the operation of the machine and it is ready for another subject.

On the left side of the case is mounted a small electric dryer, which is nothing more nor less than a miniature electric stove. The picture is laid on top of this until the water has evaporated and the picture is then finished. The whole operation takes about one minute.

Motors can be supplied to operate on either 110 or 220 volts direct or alternating current and the arc lamp is regulated according to the voltage of the supply current by means of an adjustable resistance placed near the top of the mechanism on the inside of the case.

THE TEXAS RADIO TELEGRAPHY ASSOCIATION

The above association has been formed for the purpose of furthering radio-telegraphy in Texas. The only requirement is that you must own and be able to operate either a sending or receiving station or both. You are cordially invited to send your call letters, data, etc., for classification.

Advice from individuals and associations will be greatly appreciated.

Address all correspondence to the club or the secretary, Valjean Hentz, Box 599, Dallas, Texas.

THE CANADIAN CENTRAL WIRELESS CLUB

At a recent meeting of the Canadian Central Wireless Club, the election of officers took place as follows: Alexander Polson, president; E. A. Dunn, vice-president; Harold E. Mott, Armstrong's Point, Winnipeg, Canada, secretary and treasurer.

PORTABLE SHEAR—MOTOR OPERATED

The accompanying illustration shows a novel use of an electric motor—operating a portable shear. This machine is a very valuable adjunct to a wholesale hardware house, a factory storeroom, a railroad shop, or any place where metal bars or strap is to be cut into different lengths as needed.

The truck, which carries the shear and a five horse power motor, is drawn to the front of any bin of metal where a piece is drawn out and the required lengths cut off, without the time and

labor of carrying the metal to a stationary shear, which may be some distance away. Electric current for the motor is conveyed to it through a flexible conductor cable, which connects to any of several junction boxes conveniently placed near the bins.

THE DISC DISCHARGER

(*Continued from page 341*)

of 15,000 volts. The fault most apparent in this scheme was that it was very hard to differentiate between signals sent out from the transmitting station and those emanating from atmospheric electrical disturbances, so it was modified a little by affixing copper studs at regular intervals in its periphery and placed transversely to its plane. The discs, A and B, were also rotated at high speed. As the studs came opposite the smaller side discs they just did not touch same and this is the way all rotating gaps should be made, so that the resistance across the gap will be as small as possible while the studs are letting current pass across. See Fig. 24. When using these studs the oscillations are broken up into wave trains the frequency of which is generally a musical note, depending on the speed of the disc. Referring again to the reactions that take place in the oscillation transformer If we possess nothing but an ordinary gap we can decrease this reaction by separating the two coils till the mutual induction is lessened, but as the magnetic field decreases in strength as we go farther away from the coil it will be seen that the amount of energy radiated by the antenna will be very greatly reduced and we have a waste of energy. The proper way to overcome this reaction between the two coils of the oscillation transformer is to provide a gap in which the gases generated by the heat of the spark are made away with as fast as they are formed. This can be accomplished by the gap illustrated in the cut. It consists of an aluminum disc about 18 inches in diameter mounted on suitable bearings and rotated at a speed of 2000 to 3000 R. P. M., but the faster the disc is run the greater will be the cooling effect. The arrangement of the closed circuit is shown in Fig. 25, the leads of an ordinary wireless transformer being connected to the condenser terminals, A and B.

Note.—Unless this disc is provided with teeth or studs it will not produce a musical note.—Ed.

THE MISSISSIPPI WIRELESS ASSOCIATION

This association has been formed for the purpose of assisting the members in any manner necessary to improve their efficiency in operating. The following officers were elected: Paul Robertson, president; John R. DuBerry, vice-president; Miss Clara Hill, treasurer; Clarence E. Albertson, secretary.

A small fee is charged to cover the expenses of membership cards. All members are invited to ask any question that they may be in doubt about, pertaining to wireless construction, or the Government operating rules.

All amateurs in the State of Mississippi are invited to send in their addresses, and other information for membership to the secretary, Clarence E. Albertson, Box 206, Tupelo, Mississippi.

Using a Wavemeter

By P. Mertz

Part III. For Measuring Capacity, Inductance, Etc.

AT the end of Part II of this article, in the last issue, it was announced that Part III would describe the method of measuring capacity, inductance, etc., by means of the wavemeter. This method of determining the above is much more accurate, reliable, and in general more satisfactory than by using a modified Wheatstone Bridge for the

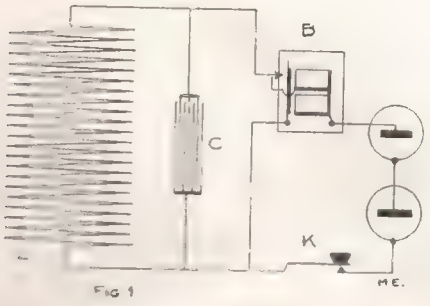


FIG 1

purpose, as is often done. Before entering upon the real work, however, it is necessary that the principle on which the method is based be explained.

It is generally understood that if we have a simple circuit containing capacity and inductance, and arrange in some way or other that electro-magnetic waves (electric oscillations) be radiated from that circuit, the wavelength of those oscillations will be given by the formula, $\lambda = 1885 \sqrt{LC}$; the wavelength being in metres, inductance in microhenries, and capacity in microfarads. It therefore follows that if we know any two of the three variable terms, λ, L and C, we can find the other by computation. If we use a standard inductance (when we wish to measure capacity) or standard capacity (when we wish to measure inductance), and measure the wavelength by means of a wavemeter, it is obvious that we have two of the variable terms in the equation; which can then be solved to find the third. This last will then be the value of the unknown.

Now that the principle has been explained, and, it is hoped, clearly understood by the reader, the details, as carried out in actual practice will be taken up. The measurement of inductance will be taken up first. The circuit containing the unknown inductance is shown in Fig. 1. L is the inductance, C is a condenser of known capacity, B is a buzzer operated by cells controlled through a key, as illustrated. The condenser, C, can be one purchased from a wireless supply house, who will generally know its exact capacity. This capacity should be such that when connected with the unknown inductance, the resulting wavelength will be well within the range of the wavemeter. This can, as a rule, be easily approximated.

If a condenser of known capacity cannot be had, it can be constructed. About the best design for such a condenser is shown in Figs. 2, 3, and 4.

It consists of brass or aluminium plates, A, of any suitable size and number, mounted between insulating washers, B. These washers can be cut from sheet fibre or hard-rubber, if they cannot be had already machined. It is highly important that they be all of the same thickness, between 1/8 and 1/32 inch, and that this thicknes be known

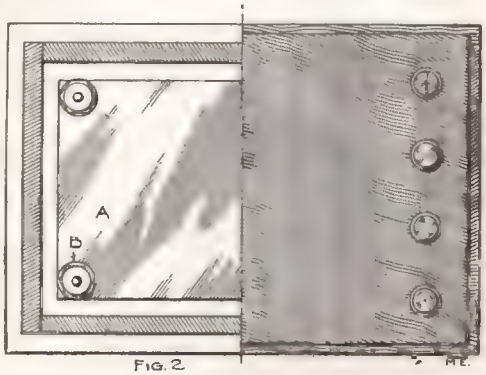


FIG. 2.

with some degree of accuracy. Bolts, C, are used to clamp the plates together and to the baseboard, D. The best method to insure against the plates, A, touching C, causing a short circuit, is to enclose the bolts, C, in

hard-rubber or fibre sleeves, E. An almost equally good method is to use soft rubber tubing, which is much less expensive, for sleeves.

The whole condenser is, for protection, enclosed in a box, on the top of which are mounted binding-posts. As many binding-posts should be used as there are plates, and each plate connected to one post. Adjacent plates should be connected to posts on opposite sides of the box; that is, the first plate connected to the first post on the left of the box, the second plate to the first post on the right, the third plate to the second post on the left, etc., as condensers are usually connected. With this arrangement, it will be seen later, a wide range of capacities can be

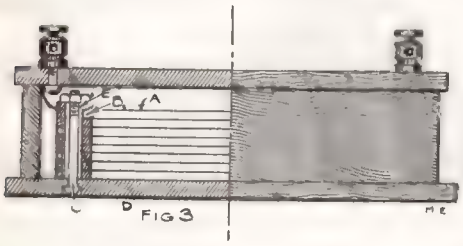


FIG. 3

obtained, even though using as little as eight plates.

After the condenser has been constructed, the capacity between any two adjacent plates should be determined by the well-known formula

$$C = \frac{0.2248 \times a}{t \times 10{,}000{,}000{,}000}$$

where C = capacity in microfarads
a = area of active surface in square inches
t = thickness of dielectric in inches.

It will be noticed why air is preferable here as a dielectric to certain other substances, for its dielectric constant is always 1, and its dielectric losses practically zero, while that of others cannot be predetermined with any great degree of accuracy. Some values of capacity obtainable with different connections, using an eight-plate condenser, in terms of the capacity between two adjacent plates, are shown in Fig. 5. Thus at F, Fig. 5, the number 4 means that the capacity of the condenser when wired in that particular way is equal to 4 times the capacity between any two adjacent plates in the condenser. If less than 8 plates have been used in the latter, the values will be exactly the same, when up to 8 plates are used. When more than 8 plates are used the values will be correspondingly higher.

Coming back to Fig. 1, the induct-

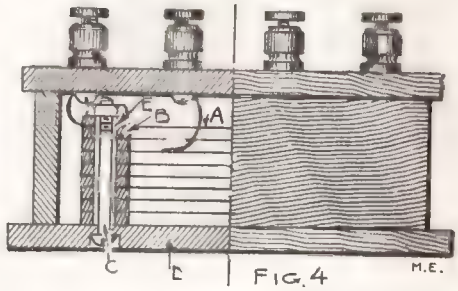


FIG. 4

ance to be measured, condenser, etc., are connected as illustrated. The wavemeter detector is adjusted to a sensitive condition, and potentiometer shunt disconnected. The wavelength of the buzzer transmitting circuit is determined. Fig. 6 is then referred to, and the value of LC for that particular wavelength is found. This is divided by the capacity of the condenser, and the result is the inductance of L, Fig. 1. All this actually takes much less time than to describe it, especially after a little practice.

The measurement of capacity by the wavemeter method is very similar to that of inductance. A coil of known inductance is connected as illustrated

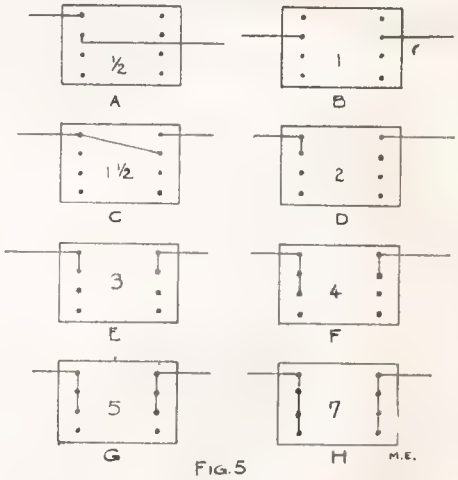


FIG. 5

at L, Fig. 1, while the capacity to be measured is shown at C. The buzzer is operated and the wavelength meas-

ured by means of the wavemeter. The corresponding value of LC is found from Fig. 6, divided by the inductance and the result is the capacity of C. The inductance of the coil, C, can be computed by a number of formulas, some extremely complicated, but the following will be found the most satisfactory for general work. When the coil consists of only one layer, as an ordinary tuning coil.

$$L = \frac{(5 \times D \times T)^2}{1000\ (M + \frac{1}{3}\ D)}$$

where L = inductance in microhenries
D = diameter of coil in inches
T = number of turns
M = length of coil in inches.

When the coil consists of several layers,

$$L = \frac{(5 \times D \times T)^2}{1000\ (1/3D + 3/2M + 5/4N)}$$

where D = average diameter in inches
N = depth of winding in inches.

In some cases a coil of known inductance is not on hand when the capacity of a condenser is to be measured. However, if another condenser, of known capacity, can be obtained, there is a method for measuring the first capacity, known as the "substitution method."

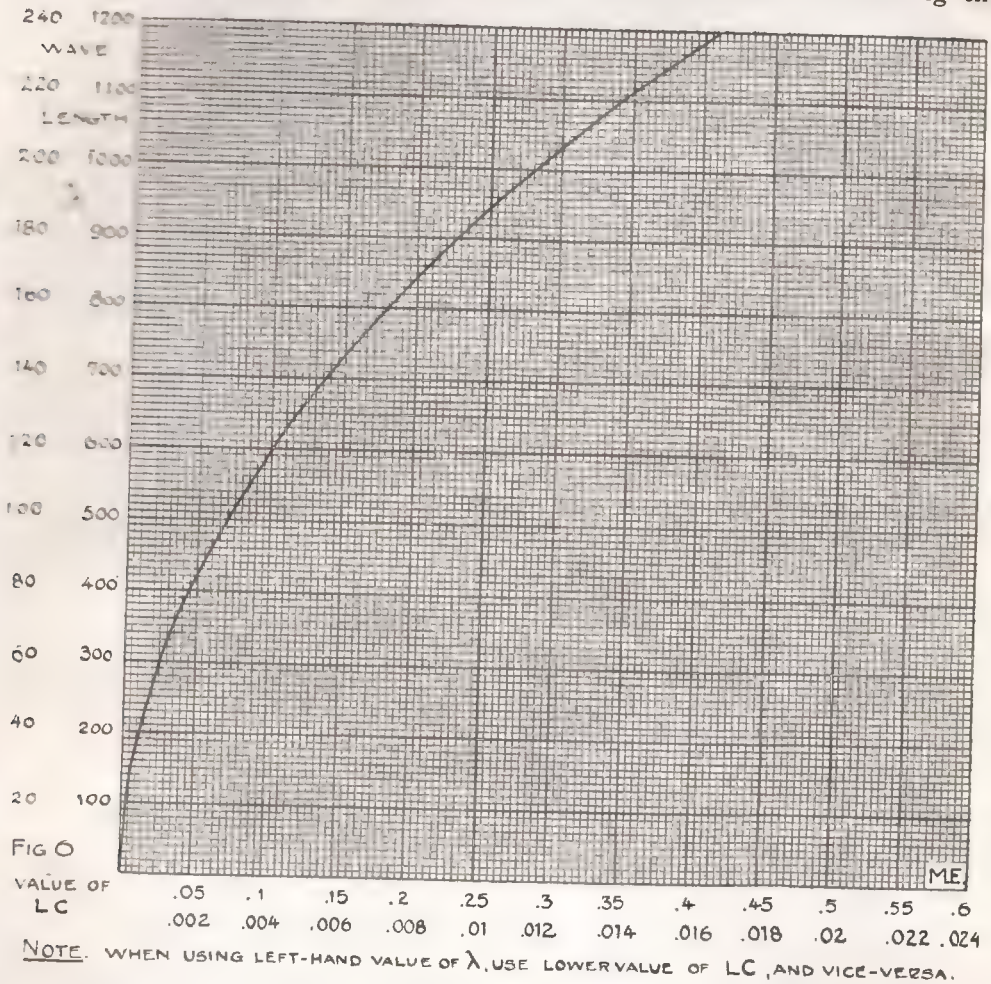


FIG 6

NOTE. WHEN USING LEFT-HAND VALUE OF λ, USE LOWER VALUE OF LC, AND VICE-VERSA.

In this method, the unknown capacity, C_x, is connected with any suitable inductance, as shown in Fig. 1. The wavelength, λ_x, of the circuit is determined by means of the wavemeter. Then the known capacity, C, is substituted for the unknown, and the wavelength, λ, found. Looking at the formula, $\lambda = 1885\ \sqrt{LC}$, it will be seen that it can be written, $\lambda = 1885\ \sqrt{L}\ \sqrt{C}$.

Consideration of the latter will show

that λ is directly proportional to the square root of C, L remaining constant. Therefore, $\sqrt{C} : \sqrt{C^x} :: \lambda : \lambda^x$, from which we get the formula

$$\lambda \sqrt{C^x} = \lambda^x \sqrt{C}$$

Simplifying,

$$C^x = \frac{\lambda^{2x} C}{\lambda^2}$$

Substituting the appropriate numbers as found above, for λ, C, and λ^x, the value of C^x, the capacity of the condenser being measured, can be readily found.

Obviously the same procedure can be carried out when measuring inductance and no condenser of known capacity is obtainable.

Besides the measurements of capacity and inductance, there still remains something to speak about, namely, the determination of the damping of any oscillation circuit. This was very elaborately described in Part I, under the uses of the wavemeter in connection with the transmitting set. Since this was published, however, the writer has found a much more expeditious, though perhaps less accurate, way, which is here described.

The wavemeter is adjusted and prepared exactly as was described before.* The wavelength at resonance, λ_1, is found, and the intensity (λ) of the current then flowing through the wave-meter measured by means of the potentiometer shunt. The potentiometer slider is then adjusted to read exactly half the value of λ and the wavelength increased or decreased until the sounds are just audible in the receivers. This latter wavelength is called λ_2. Then

$$\delta_1 + \delta_2 = \frac{3.55\ (\lambda - \lambda^1)}{\lambda_1}$$

In the above, the expression $\lambda - \lambda^1$ means the difference between λ_1 and λ_2, whether the latter is greater or less than the former. From the value thus obtained the decrement of the wavemeter is subtracted, to get the true decrement, as was explained before.

In conclusion, the hope is expressed by the writer that the amateur in general will, to his own benefit, learn to appreciate the great value of the wavemeter and the intelligent use of it, to a greater extent than heretofore.

*See p. 128 May issue.

RADIO CALL LETTERS

DEPARTMENT OF COMMERCE
OFFICE OF THE SECRETARY
WASHINGTON

BUREAU OF NAVIGATION

MAY 9, 1913.

The following instructions concerning radio call letters are issued for the information of those concerned, pending the issue of the Lists of Radio Stations of the World and of the United States, which will not be published before July.

1. Section 7 of the act of August 13, 1912, to regulate radio communication provides:

SEC. 7. That a person, company, or corporation within the jurisdiction of the United States shall not knowingly utter or transmit, or cause to be uttered or transmitted, any false or fraudulent distress signal or call or false or fraudulent signal, call, or other radiogram of any kind. The penalty for so uttering or transmitting a false or fraudulent distress signal or call shall be a fine of not more than two thousand five hundred dollars or imprisonment for not more than five years, or both, in the discretion of the court, for each and every such offense, and the penalty for so uttering or transmitting, or causing to be uttered or transmitted, any other false or fraudulent signal, call, or other radiogram shall be a fine of not more than one thousand dollars or imprisonment for not more than two years, or both, in the discretion of the court, for each and every such offense.

2. The Service Regulations of the Berlin and London Radiotelegraphic Conventions provide that the call letters of stations in the international system must each be formed of a group of three letters which shall be distinguishable from one another. The London International Radiotelegraphic Conference made a partial allotment of call letters among nations which signed the convention and the International Bureau at Berne, with the consent of such nations, has modified and added to this assignment of call letters by circular of April 23, 1913. The distribution of call letters among nations thus authorized is printed below for the guidance of operators of all stations, ship and shore, of the United States.

A ..... All to Germany and protectorates.
B ..... All to Great Britain.
CAA to CMZ... Not yet assigned.
CNA to CNZ... Morocco.
COA to CPZ... Chile.
CQA to CQZ... Monaco.
CRA to CTZ... Portugal and colonies.
CUA to CUZ... Not yet assigned.
CVA to CVZ... Roumania.
CWA to CWZ.. Uruguay.
CXA to CZZ... Not yet assigned.
D ..... All to Germany and protectorates.
EAA to EGZ... Spain and colonies.
EHA to EZZ... Not yet assigned.
F ..... All to France and colonies.
G ..... All to Great Britain.
HAA to HFZ... Austria-Hungary and Bosnia-Herzegovina.
HGA to HHZ.. Siam.
HIA to HZZ... Not yet assigned.
I ..... All to Italy and colonies.
J ..... All to Japan and possessions.
KAA to KCZ... Germany and protectorates.
KDA to KZZ... United States.
LAA to LHZ... Norway.
LIA to LRZ.... Argentine Republic.
LSA to LWZ... Not yet assigned.
LXA to LZZ... Bulgaria.
M ..... All to Great Britain.
N ..... All to the United States.
OAA to OFZ... Not yet assigned.
OGA to OMZ.. Austria-Hungary and Bosnia-Herzegovina.
ONA to OTZ... Belgium and colonies.
OUA to OZZ... Denmark.
PAA to PIZ... Netherlands.
PJA to PJM... Curaçao (Dutch).
PJN to PJZ.... Surinam (Dutch).
PKA to PMZ... Dutch East Indies.
PNA to PZZ... Not yet assigned.
Q ..... Reserved for code abbreviations.
R ..... All to Russia.
SAA to SMZ... Sweden.
SNA to STZ... Brazil.
SUA to SUZ... Egypt.
SVA to SZZ... Greece.
TAA to TMZ.. Turkey.
TNA to TZZ... Not yet assigned.
UAA to UMZ.. France and colonies.
UNA to UZZ... Austria-Hungary and Bosnia-Herzegovina.
VAA to VGZ... Canada (British).
VHA to VKZ... Australian Federation (British).
VLA to VMZ... New Zealand (British).
VNA to VNZ.. South African Union (British).
VOA to VOZ... Newfoundland (British).
VPA to VSZ... British colonies not autonomous.
VTA to VWZ.. British India.
VXA to VZZ... Not yet assigned.
W ..... All to the United States.
XAA to XCZ... Mexico.
XDA to XZZ... Not yet assigned.
YAA to YZZ... Not yet assigned.
ZAA to ZZZ... Not yet assigned.

PUBLIC-SERVICE STATIONS.

3. The call letters assigned to the United States are all combinations (676) beginning with the letter N and all (676) beginning with letter W and all combinations (598) from KDA to KZZ, inclusive. The total number of international call letters assigned to the United States is thus 1,950 and these are reserved for Government stations and stations open to public and limited commercial service.

(*a*) All combinations beginning with the letter N are reserved for Government stations and in addition the combinations from WUA to WVZ and WXA to WZZ are reserved for stations of the Army of the United States.

(*b*) The combinations KDA to KZZ, with a few exceptions, are reserved for ship and coast stations on the Atlantic coast and Gulf of Mexico.

(*c*) The combinations beginning with W (except WUA to WVZ and WXA to WZZ as already indicated) are reserved, with a few exceptions, for ship and coast stations on the Pacific coast and on the Great Lakes.

AMATEUR STATIONS.

4. The call letters for amateur stations in the United States will be awarded by radio inspectors, each for his own district, respectively, according to the following system:

(*a*) The call will consist of three items; number of radio district; followed by two letters of the alphabet. Thus, the call of all amateur stations in New England (which comprises the first district) will be the figure "one" in Continental Morse, followed by two letters; in California (in the sixth district) the figure "six" followed by two letters; in South Carolina the figure "four" followed by two letters; in Missouri the figure "nine" followed by two letters, etc. The letters X, Y, Z, must not be used as the first of the two letters. The territory of each district is as follows:

1. Boston, Mass.—Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut.

2. New York, N. Y.—New York (county of New York, Staten Island, Long Island, and counties on the Hudson River to and including Albany, Rensselaer, and Schenectady), and New Jersey (counties of Bergen, Passaic, Essex, Union, Middlesex, Monmouth, Hudson, and Ocean).

3. Baltimore, Md.—New Jersey (all counties not included in second district), Pennsylvania (counties of Philadelphia, Delaware, all counties south of the Blue Mountains, and Franklin County), Delaware, Maryland, Virginia, District of Columbia.
4. Savannah, Ga.—North Carolina, South Carolina, Georgia, Florida, Porto Rico.
5. New Orleans, La.—Alabama, Mississippi, Louisiana, Texas, Tennessee, Arkansas, Oklahoma, New Mexico.
6. San Francisco, Cal.—California, Hawaii, Nevada, Utah, Arizona.
7. Seattle, Wash. — Oregon, Washington, Alaska, Idaho, Montana, Wyoming.
8. Cleveland, Ohio.—New York (all counties not included in second district), Pennsylvania (all counties not included in third district), West Virginia, Ohio, Michigan (Lower Peninsula).
9. Chicago, Ill.—Indiana, Illinois, Wisconsin, Michigan (Upper Peninsula), Minnesota, Kentucky, Missouri, Kansas, Colorado, Iowa, Nebraska, South Dakota, North Dakota.

(*b*) The three items; a given figure first, followed by two letters of the alphabet, thus may be combined in 598 different calls, which will probably suffice for the amateur sending stations in most districts for some time to come.

(*c*) Radio inspectors will insert amateur station calls in station licenses according to this system, and will keep a permanent chart, of 598 squares, lettered with the alphabet from left to right and from top to bottom (A to W), inserting in the appropriate square the serial license number of the station to which the call letters were awarded. Within these limitations radio inspectors will use their discretion in the award of calls, avoiding, of course, duplications.

(*d*) When a station is abandoned and the license canceled, or if a license shall be forfeited for violation of law, the call assigned to it may be allotted to another station.

(*e*) If the entire 598 calls have been exhausted, radio inspectors will issue additional calls, consisting of the figure of the district followed by three letters. From such combinations should be excluded the combination SOS, and PRB, all three-letter combinations beginning with QR or QS, all combinations involving the repetition of the same letter three times, three-letter combinations beginning with K, N, W, X, Y, Z, and other combinations, which, for various reasons, international, national, local, or individual, may be objectionable. With such exclusions, over 10,000 calls will remain for each district.

LIMITED COMMERCIAL STATIONS.

5. Calls for limited commercial land stations will be allotted by the Bureau of Navigation in a special manner to indicate, if practical, the different radio districts over which such stations usually radiate messages, as well as to identify the stations.

SPECIAL CLASSES OF STATIONS.

6. Calls for special classes of stations, such as experiment stations for the development of radio communication, technical and training school stations, and special amateur stations will be allotted by the Bureau of Navigation.

The call will consist of three items, the number of the radio district, followed by two letters of the alphabet. The first letter will be: X, for experiment stations; Y, technical and training schools; Z, special amateur stations.

Twenty-six different combinations for each class in each district, of course, are possible. If more should prove necessary for any class in any district, a third letter will be added to the call.

E. T. Chamberlain,
Commissioner of Navigation.

Approved:
Edwin F. Sweet,
Assistant Secretary.

CANADIAN TRANSATLANTIC WIRELESS SERVICE

A bill is before the Canadian Parliament authorizing the Government to contract with the Poulsen interests for the use of the Poulsen wireless system for transatlantic service.

FIRE IN C. BRANDES FACTORY

On May 26th a fire occurred in the laboratory of C. Brandes, Inc., at 111 Broadway, which partially destroyed the shop and quite an amount of finished and unfinished stock.

Mr. Dietrich of this concern informs us that while the fire will delay somewhat the shipment of the receivers and apparatus now on order, they will very shortly be in a position to resume full operation of the plant, and get their orders out promptly.

Simple Experiments in Alternating Currents

(Continued)

By P. Mertz

Three-Phase Currents

30. Three-phase currents are very similar to, and a modification of, two-phase currents, which we have just been studying. The preliminary explanation of these will, therefore, be very simple.

Suppose we have three alternators, equal in every respect, running at the same speed, and running such that when the current generated by one is at maximum, the currents generated by the other two are also at maximum; and when the current generated by any one is at zero, the currents generated by the other two are also at zero. These three separate currents can then be represented by the three line curves, A, B, and C, shown in Fig. 68. If now we time the generators such that the maxima of the currents do not all occur at the same time, but are distributed evenly throughout the cycle, we shift the curves as shown at A, B, and C in Fig. 69. Here it will be noticed that each curve is made to lag 60° behind the one preceding it. Now, if we mounted the armature windings of the three generators upon one armature core, keeping the wiring of each winding separate from that of the others, we would obtain a three-phase alternator, and, plotting the curves of the separate currents on the same zero-line or axis, we obtain the diagram shown in Fig. 70. It is to be noticed that in this diagram, at any point in the cycle, the algebraic sum of the three currents is always equal to zero; and that, when any curve is at its maximum, the other two intersect on the other side of the axis or zero-line, at a distance from that line equal to half the maximum.

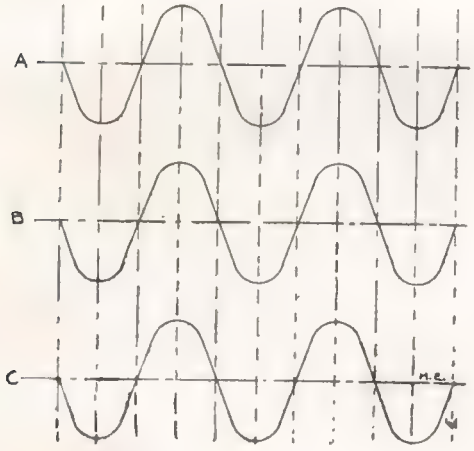


FIG. 68

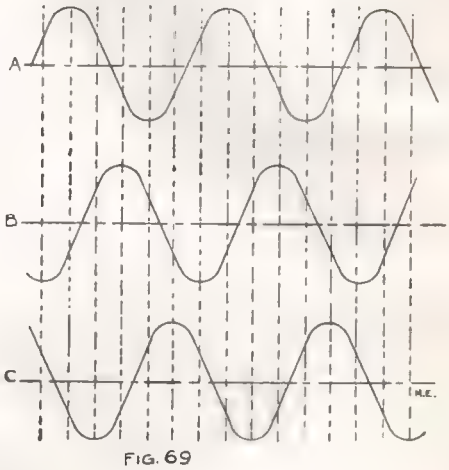


FIG. 69

31. From the above it will be seen that a mechanical converter or commutator, on the same plan as those used for single* and two-phase† currents, can be constructed for obtaining three-phase currents from batteries. Such a converter is shown in Figs. 71, 72 and 73. It consists of the usual framework and commutator cylinder, together with suitable brushes and binding posts.

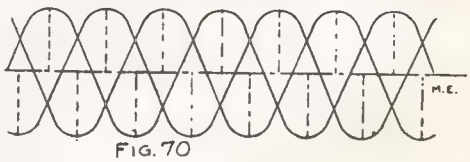


FIG. 70

*See p. 154, May, 1912, issue.
†See p. 921, December, 1912, issue.

On this latter are mounted four crown-shaped rings, two of which have the crown teeth on both sides. Fig. 73 gives a view of the commutator cylinder as if it had been split its whole length, opened up, and spread out flat.

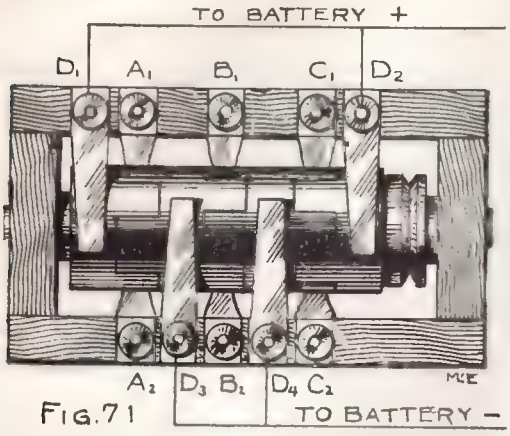


FIG. 71

The black rectangles represent the places at which the brushes should bear. These should be carefully noticed, as, if they are changed to any great extent, the currents given out by the converter will not have the right phase relation to each other. The batteries are connected to the converter as indicated in the diagram.

Alternating current can be obtained from A_1 A_2, B_1 B_2, and C_1 C_2 (like letters denoting the same circuit) when

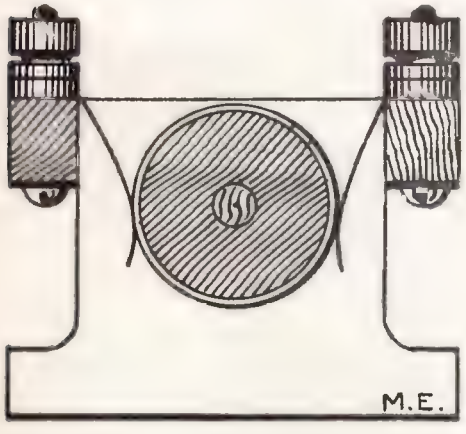


FIG. 72

the commutator cylinder is rotated. Little explanation, it will be noticed, has been given here of the details of the construction of the mechanical converter, as these would merely be a needless repetition of what has been given under the single and two-phase converters.

32. Besides obtaining three-phase current by converting battery current, it is also generated by suitable alternators. Suppose that in Fig. 64 we tie three coils together instead of two, the distance between the centers of the consecutive coils being equal to one-third the distance between any two consecutive like poles of the permanent magnets. This combination is

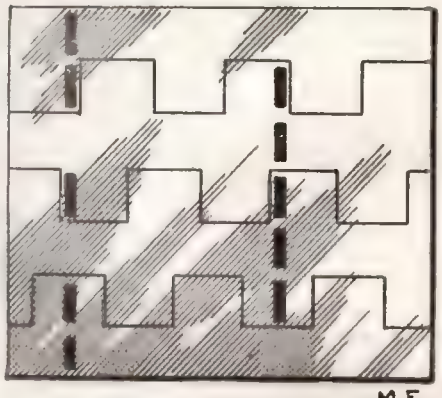


FIG. 73

shown in Fig. 74. Each coil is connected, it can be seen, to a winding around a compass, acting as galvanoscope. When the coils are passed quickly in front of the permanent magnets in the direction of the arrow, it will be noted that while one compass is deflected most, the other two compasses are each deflected about equally, in the direction opposite to that of the first compass. This agrees with what was observed in § 30, Fig. 70, and the current generated by the coils while passing in front of the permanent magnet is a three-phase current. If we now mount another set of coils, shown by the dotted lines, always keeping it 360° away from the first set, and connect each coil in series or parallel with its corresponding one in full lines, we will get either more voltage or more current from the device than we would if there were only one set of coils. In this way the number of sets of coils can be increased indefinitely.

If now we go a step further and wind all the coils upon an iron armature,

provide collector rings for the delivery of the generated current, and arrange all the field-poles in a circle around

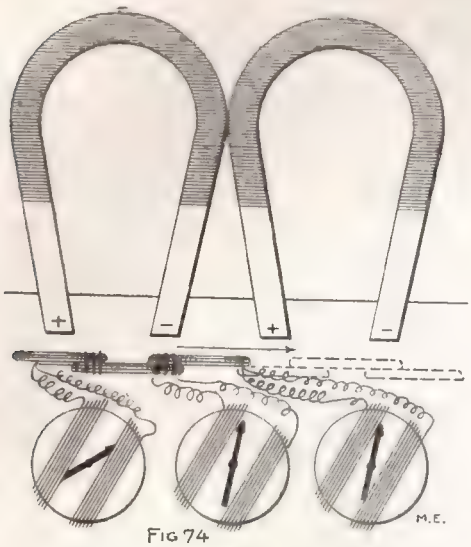


Fig 74

the armature, so as to be able to directly utilize rotary motion, we will have all the essentials of a simple three-phase alternator (Fig. 75). This alternator is similar in actual construction to the two-phase type described before (§ 29, Fig. 66.*)

As with that type, it has been found more advantageous (for certain reas-

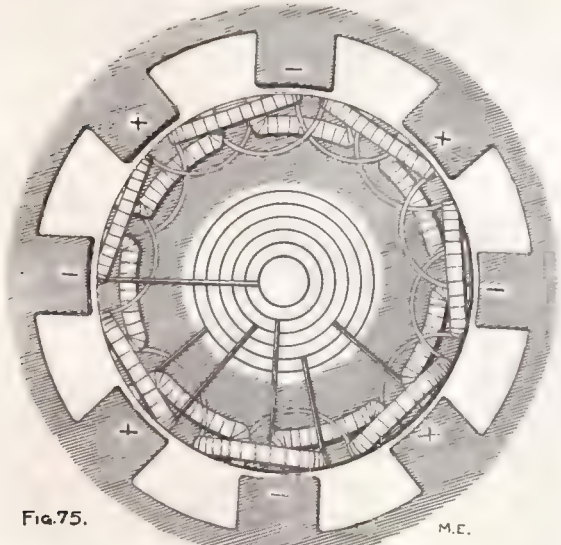


Fig.75.

ons mentioned in connection with the two-phase alternator) to construct the machine such that the field-poles revolve inside the armature, which then takes their place.

(To be continued)

*See p. 252, June, 1913, issue.

RADIO CALL LETTERS AND CODE CHARTS

In another part of this issue we reproduce, through the courtesy of the Department of Commerce, the Department's instructions regarding Radio Call Letters and two charts, forms 772, List of Abbreviations to be used in Radio Communication; and 773, International Morse Code and Conventional Signals. It is hoped that our readers will find these interesting and useful.

In connection with the instructions regarding radio call letters it will be noticed that in the first paragraph it is stated that the Lists of Radio Stations of the World and of the United States will not be published before July. Until these lists are published it is useless for us to attempt to publish our Blue Book and we trust our readers who have ordered copies of the Blue Book will not object to waiting until we can get the necessary information from which to make the book up.

ST. LOUIS TO RICHMOND, IND. RELAY

In order to establish a relay between St. Louis and Richmond, Ind. (this being part of the relay to be established between St. Louis and New York), all amateurs living in St. Louis and Terre Haute and between these points are requested to send their call letters, powers, approximate sending and receiving radius and their full address, including name of county, to V. H. Pardick, 320 South 8th Street, Richmond, Ind.

BEDFORD RADIO ASSOCIATION

The Bedford Radio Association has just been formed, the officers are as follows: R K. Story, president; G. Hotchkiss, secretary; R. W. Scofield, assistant secretary; J. A. Ballard, chief operator. The general call is BRA.

This department is established for the purpose of encouraging the experimenter to bring out new ideas. Every reader is welcome to contribute to this department and new ideas will be gladly received. CONTRIBUTIONS SHOULD BE WRITTEN ON ONLY ONE SIDE OF THE SHEET AND SHOULD PREFERABLY BE TYPEWRITTEN. IF TYPEWRITTEN THEY MUST BE DOUBLE SPACED. SKETCHES MUST BE ON SEPARATE SHEETS FROM THE TEXT. The description should be as short as possible. Good sketches are not required, as our art department can work up rough sketches which are clear enough to illustrate the idea. Return postage must be enclosed if return of unusued manuscript is desired.

THREE PRIZES OF FIVE, TWO AND ONE-HALF DOLLARS AND ONE DOLLAR ARE AWARDED for the three best ideas published each month. All other contributions appearing in this department are paid for at regular space rates.

FIRST PRIZE

OVERCOMING DEAD ENDS AND LOSSES CAUSED THEREBY

How many wireless fiends throughout the country are wasting about 40 per cent. of the energy received by the use of loose-couplers and coils that afford no regulation as to the dead end effect? A very large percentage, I dare say, in spite of the loss entailed. There is, however, a simple way to overcome dead end effects to a large extent. Let us suppose that we have a loose-coupler with a secondary winding of 200 turns. In order to tune to a certain station we

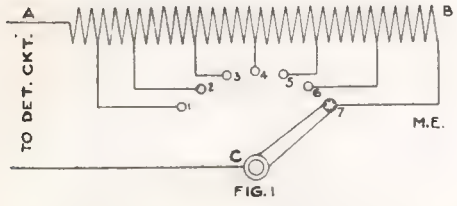


FIG. 1

use only 130 turns, 70 turns are on the coil absolutely useless. Because these extra turns are electrically connected to the rest of the coil they cause a loss known as the "dead end loss or effect." Therefore if we could by some means cut out those extra 70 turns without unwinding the coil we are in a position to cut out this loss and greatly increase the efficiency of the set, thereby rendering audible many signals that could not be picked up before, and increase the range of the set. Here is a simple and effective way of doing it.

Let AB represent the secondary winding of an ordinary loose-coupler with 6 to 8 taps taken out to the switch, C.

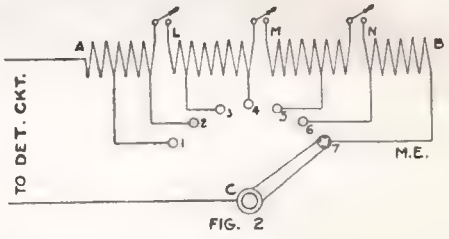


FIG. 2

Now if the switch rests on point, 3, then all the wire from 3 on to the right is not in use and consequently all we have to do is to cut the wire at points along the coil and fasten the ends to the buttons and levers of single pole switches. This is easily done and is represented in Fig. 2. The more of these the better; but generally three or four are all that are needed. They should be so marked that the operator knows how many points he can move the main switch, C, over without closing one of the other S. P. switches—L. M. N. By a little practice one can become proficient and pick up many stations all around that were not heard before. Much sharper tuning can be had and interference reduced to a minimum.

This cannot fail and is a step ahead in the field of improved radio-apparatus.

Contributed by

Harold Peterson.

SECOND PRIZE
SIMPLE METHOD OF FINDING FREQUENCY OF ALTERNATING CURRENT

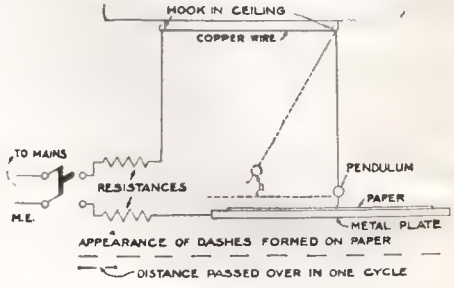
It is sometimes convenient to know the frequency of an alternating current and as most experimenters do not have a frequency meter at their disposal, the following is a simple method of determining the number of cycles per second:

A small metal ball is suspended by a piece of copper wire about eight or ten feet long. A piece of flexible wire projects down below the ball to act as a contact brush. A metal plate, such as a piece of sheet zinc, is placed directly under the pendulum. Soak a piece of unglazed paper in a strong solution of common salt and place it on the metal plate. Then pour a little phenol-phthalein solution over the sheet of paper. Connect the metal plate to one side of the circuit to be tested and the wire from the pendulum to the other side of the circuit. Resistances should be inserted to prevent a direct short-circuit.

As the pendulum is swung across the piece of paper, the contact wire on the pendulum runs over the surface of the paper. Sodium hydroxide, NaOH, is formed during the half of the cycle when the pendulum is negative, and hydrochloric acid, HCl, during the positive half of the cycle. The NaOH formed turns the phenol-phthalein solution red, while the acid does not affect it. Hence a series of red dashes will be obtained, each indicating the negative half of a cycle. The length of each mark will depend upon the velocity of the pendulum. The velocity of the pendulum is easily found from the formula $V = \sqrt{2\,gh}$, were g is the acceleration of gravity = 980 cm. per sec. per sec., and h is the height to which the pendulum bob is raised when released at the beginning of its swing.

The frequency is then found by dividing the velocity of the pendulum per second by the distance it passes through in one cycle as indicated by measuring a complete cycle marked on the paper.

As an example of the application of this method, we raised the pendulum to a height of 10 cm. Hence $V = \sqrt{2\,gh} = \sqrt{2 \times 980 \times 10} = 140$ cm. per sec., velocity of the pendulum. We measured the distance the pendulum passed through in nine cycles as indicated by nine red dashes and found it to be 21 cm. Therefore the pendulum passed through $\frac{21}{9} = 2.33$ cm. during one cycle.



Then the frequency $= \frac{140}{2.33} = 60.09$ cycles per sec.

Any sensitive indicator could be used in place of the Phenol-phthalein, although phenol-phthalein will probably give the best results. A solution of potassium iodide and starch might possibly be used. In this case a series of blue dashes would be formed.

Contributed by

Harold H. Beverage.

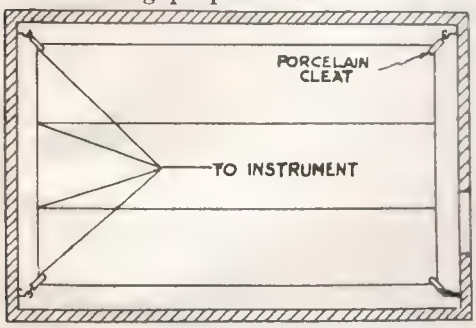
THIRD PRIZE
INDOOR AERIALS

There seems to be a general opinion among amateurs that it is impossible to get good results with an indoor antenna. A good many radio experimenters are unable to put aerials upon their roofs For these an indoor wire is quite practical. I will say, however, that it is advisable to use an outdoor aerial whereever possible. Indoor aerials, also, are

only suitable for use in the city, for the receiving range usually does not exceed 50 miles over land, and about 300 over water at night.

An indoor aerial, however, will not work with inferior instruments. A bad detector means failure. The best crystal to use is galena. Get a good sensitive piece and use a No. 30 copper wire to make contact. Galena works best with a type of detector stand using a crude adjustment. Silicon may be used, but iron pyrites does not seem to work well on an indoor antenna.

For tuning purposes it is best to use



a loose coupler. A double slide tuner will do, but the signals do not come in nearly as loud. I have never used a three slide tuner, but I believe that it would work very well on an indoor wire. The adjustment should be made by switches, even on the primary of the tuning transformer. If you use a slider it will make contact on more than one turn. This will cause weakening of incoming signals. Strong signals will come in just as well on a slider; the switch contact shows its superiority on weak signals. A good loose coupler is described on page 136 of the May, 1913, number of *Modern Electrics*. An ordinary loose coupled tuner will go as far up as 1,000 meters when used with a 25-foot indoor aerial, that is, it will tune in NAH. A variable condenser across the primary will help.

Head phones should be of the high resistance type. It is possible to use a 75 ohm receiver, but a double head band set of 2,000 ohms resistance will give far better results.

The aerial may be put up as shown in diagram. No spreaders are used. Steer clear of gas pipes as much as possible; they cut down your range. A single wire running through a flat works well. Any type of wire used for aerials will do. It is not necessary to solder connections on the aerial, since same is not exposed to the weather. Let your antenna cover as much space as possible. I have heard signals loud using a No. 22 copper wire about 50 feet long, and have done pretty fair work with a ten wire aerial 12 by 5 feet, but this last is rather too small for practical receiving.

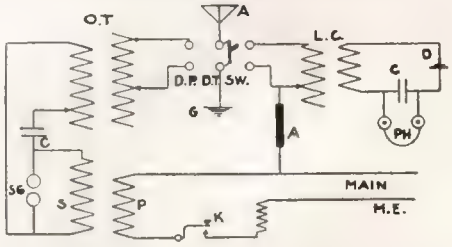
It is quite possible to do short distance transmitting with an indoor wire. I have transmitted four blocks with the small aerial mentioned above, using a ¼ inch spark coil. However, I do not recommend an indoor aerial for sending, as the gas chandeliers absorb most of the energy you radiate. In spite of this, an indoor wire will be quite satisfactory if you want to communicate with some one not more than two city blocks away.

With an indoor aerial consisting of four aluminum wires 25 feet long, a loose coupler, fixed condenser, 2,000 ohm head set, galena detector, and gas pipe ground, I have heard boats as far as 300 miles out. When FNK was working on an 3,000 metre wave you could hear him come in with the phones three feet off. He does not come in quite as well now, but loud enough. WSE and WHB come in very well. Of course, anybody can get results on a long outdoor wire, but those amateurs who can not have this may use an indoor aerial and do good work with it.

Contributed by *Carl Dreher.*

TO REDUCE HUMMING

By referring to the "Oracle," one can easily see that the chief trouble experienced by amateur wireless operators is



caused by loud humming in the phones (induction) and etheric splashes (static). These are caused by arc lights, car lines, high power wires, atmospheric conflict, etc. A method by which this may be

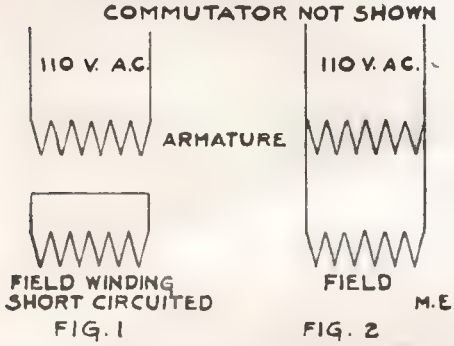
greatly reduced, though not entirely eliminated, can be seen in the diagram. A is a graphite carbon rod having an approximate resistance of 300 to 400 ohms. In some cases where atmospheric conditions are exceptionally bad, as much as 1000 ohms are needed, although this addition of ohmage diminishes the receiving range. Inclosed hook up is absolutely essential with this static eliminator.

Contributed by

Edward Werner.

D. C. MOTOR ON A. C.

I note what you say in answer to Query 2376 in the May issue. I have a ⅛ hp. Holtzer Cabot D. C. motor, which I run on A. C. with good results; the



commutator heats up very slightly, but no more than D. C., I believe. I use two circuits which I send enclosed. No. 1 does not give as much speed as No. 2.

Contributed by

Cyril B. Nelson.

A SIMPLE CONSTANT RINGING BOX

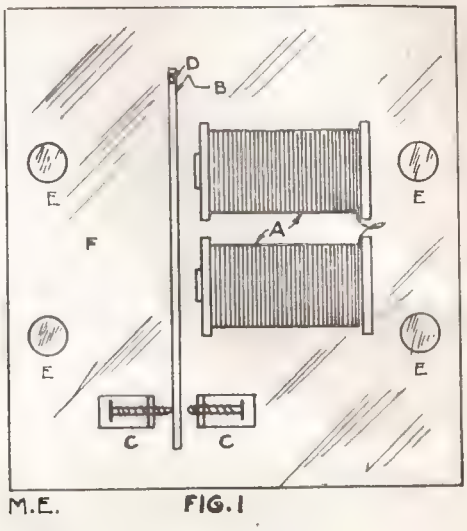
In the May issue of *Modern Electrics,* Herman Knutzen contributed an idea on how to make a burglar alarm. This is a good idea, but if the burglar heard the bell ring he would cut the wires and the bell would stop ringing. So I am sending a device so even if the burglar does cut the wires, the bell will ring just the same.

The instrument which I am going to describe may be made any size to suit the experimenter.

The materials needed are a base of wood or rubber,—wood is what I used, —some pieces of brass or copper, an armature of iron and some battery binding posts.

The first thing necessary is to get or make the magnets. They may be taken from an old bell or they may be made with a bolt, two washers and some No. 22 cotton insulated wire.

The next things to make are the con-



tact pieces. They should be made of brass or copper and should be bent as shown in Fig. 2. Drill two holes in the bottom for screws. Another hole should be drilled and threaded in the upright part.

If you haven't a tap, take a nut from a binding post and solder it as shown in

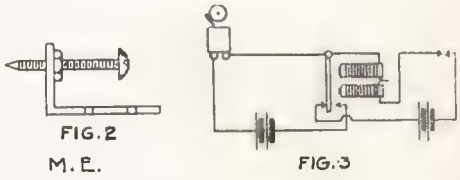


Fig. 2. Two of these contact pieces should be made. Now take the bolt of a binding post and file it to a point as shown.

Now drill a hole in the iron armature as shown in Fig. 1.

Now put the parts together as shown. After putting the magnets in place, pivot the iron armature in place. It shouldn't swing freely, but it should stick enough to hold it in any position. Of course, this does not mean that it

should stick so much that the magnets can not move it. Next screw the contact pieces in place.

After all this is done adjust the instrument by means of the binding post bolts serving as contacts.

Connect the instrument as shown in Fig. 3.

The same alarm should be used as Herman Knutzen described.

This instrument will only work in the position shown.

Contributed by

Ernest Borho.

Note.—If the burglar heard the bell he might cut the wires, but he probably wouldn't come in if he heard it before he got in.—Ed.

ANOTHER SMALL QUENCHED GAP

To make this gap you must have the following: 18 mica rings, Fig. 2; 18 copper or zinc discs, 1 common straight gap.

You can get the mica rings from any electrical supply house, and the copper circles can be made by cutting discs the size of a penny from sheet copper or zinc, or by filing or grinding pennies smooth on both sides. After grinding the mica and metal rings put a little shellac on each side of all the mica rings, being

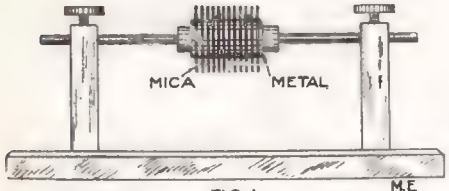


FIG. 1

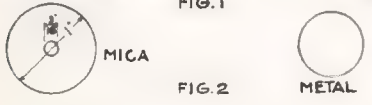


FIG. 2

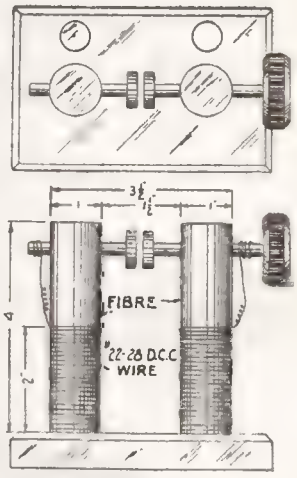
careful not to get any in the holes in the center of the rings. Now you are ready to put the gap together. Before the shellac dries lay one of the metal discs on a table and next lay a mica ring on top of it, then a metal disc, then mica and so on till you have as many as you want. You can tell the right number by experimenting. I use this gap all the time now, as it gives a very clear tone that is easy to read in the receivers.

Contributed by

Chas. Burton.

HIGH POTENTIAL CHOKE COIL FOR SECONDARY CIRCUITS

The amateur will be surprised at the increase of radiation that may be secured by the use of these simple and easily constructed choke or impedance coils in the leads running from the condenser to the secondary taps of the spark coil or transformer. A gain of



15 per cent. has been observed when using properly proportioned coils. Satisfactory proportions can be obtained only by experiment, calculation being of little assistance.

The purpose of the coils is to choke back all surges which emanate from the oscillatory or condenser circuit, and which ordinarily flow back into the secondary coil. This choking back of the high potential, high frequency surges only, is due to the different resistance the coil offers to currents of different frequencies, caused by the impedance rising with the frequency. Thus the current from the transformer, having a comparatively low frequency, passes with ease, but the very high frequency surges from the condenser are completely choked back.

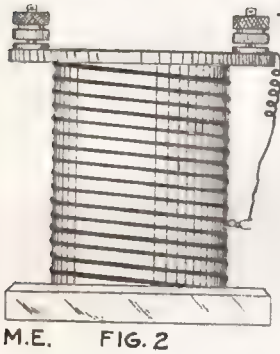
These oscillations are three-fold objectionable. They often puncture, carbonize or permanently weaken the insulation of the coil or transformer. The energy flowing back into the secondary sets up lines of force, which being neutralized by an increase in the primary current, results in an increased cost of operation. And lastly, all power used other than by the radi-

ating system (Aerial) is a direct and sensible loss. All these points result in an inefficient transmitter.

Figure 1 shows a spark gap of the common type fitted up for use with a spark coil or transformer using alternating current at 50-125 cycles (not interrupted artificially). The drawing shows both side and top views. All necessary dimensions are shown for an installation of under 250 watts.

The uprights are made from hard rubber, fibre or porcelain, measuring anywhere from 1 inch to 2 inches in diameter and wound with a number of turns No. 12 to 28 wire, cotton or enameled insulated. All dimensions depending upon the frequency (the number of turns employed decreasing and the size of wire used and the spacing increasing with the frequency).

The base may be made from any suitable material cut to the required size and given a pleasing finish. The posts are mounted by being either re-



M.E. FIG. 2

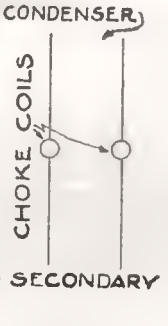


FIG. 3

cessed and cemented into the base or fastened by suitable machine screws.

The two binding posts are connected to the two lower ends of the coils respectively, the upper ends being connected to the spark gap. The binding posts are to be conected to the secondary leads.

Figure 2 shows an arrangement to be used for exceptionally high frequency coils, such as the open core transformer and electrolytic interrupter. The author has experimentally verified the following dimensions as being correct for the E. I. Co.'s ½ k. w. open core transformer coil and Gernsback interrupter; mean diameter of turns 1¾ inches. Number of turns 7 to 8. Spacing ½ inch. Wire No. 6 B & S gauge, bare. The drum is of fibre. This coil will certainly make your hot wire ammeter swing. Two coils for each installation have to be constructed one for each lead.

When a rotary gap is used, the plan of Figure 1 may be used, but the discharger shown may be omitted.

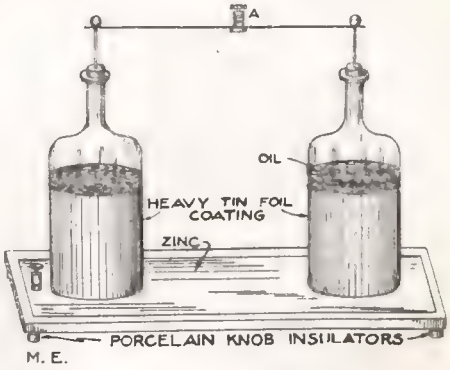
Figure 3 shows where the coils are inserted in the leads.

Contributed by

Paul Horton.

A CHEAP AND EFFICIENT HIGH TENSION CONDENSER

Having neither time nor material with which to construct the usual glass plate type sending condenser, I hit upon the following plan, and the results obtained more than repaid me for the experiment. The materials are cheap and easily obtained. First procure two or more round half-gallon glass bottles from your druggist. Now coat the outside with tinfoil for about two-thirds of their height. Coat the bottom also. Then fill the jars two-thirds full of saturated solution of common salt; this being employed to take the place of the inner coating. Next procure two good corks and after soaking them in melted paraffine bore holes in them sufficiently large to take a small brass rod, which is used to make contact with the salt solution. The lower end of this rod dips into the solution and



M. E.

the upper end terminates in a small brass ball or a binding post. Contact with the outer coating is made by resting the jars on a plate of zinc, to which is attached a binding post. To prevent brush discharge a small quantity of linseed oil

is poured on the surface of the salt water. The jars may be insulated from the table by resting the zinc plate on a board which is insulated from the table by four small porcelain knobs. I think the drawing will serve to make every point clear.

Contributed by

Roy H. Heiser.

A HIGH PITCHED ROTARY SPARK GAP

This rotary spark gap consists of the ordinary wheel (in this case should be of insulating material) with the plugs penetrating it as shown in the drawing. There are four stationary electrodes. Any number of plugs on the rotor can be used. The posts supporting the elec-

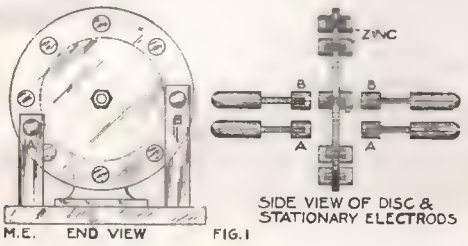


FIG. 1

trodes, B, should be higher than the posts, A, that is, they should be so constructed that when a spark passes at B none will pass at A. When a spark passes at B the electrode, A, should be half way between two of the plugs on the wheel. This arrangement gives the effect of having just twice as many plugs as there actually are on the wheel. A should be connected to B on one side of the revolving wheel, and on the other side should be connected likewise. Fig.

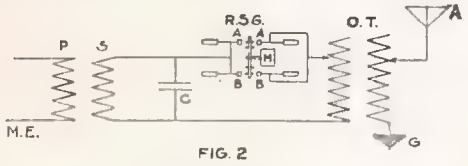


FIG. 2

2 shows the arrangement of connections.

There are gaps in use to-day which have the four stationary posts, but do not have one higher than the other, and consequently sparks pass at both A and B simultaneously. With the above arrangement a spark passes at A and B alternately and produce a higher pitched spark than if both sparked at the same time.

Contributed by

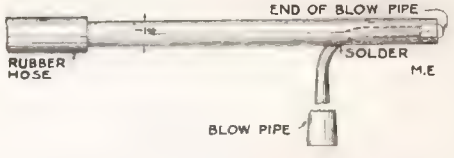
Ivyn Farwell.

Note.—The connections from the two sets of stationary electrodes should be made exactly as shown in Fig. 2. That is,—the wire to the condenser should be connected exactly in the middle of the wire connecting the two left hand electrodes and the wire to the oscillation transformer exactly in the middle of the wire connecting the two right hand electrodes. If this is not done the length of the condenser circuit will be different when the spark occurs at A from what it is when the spark is at B. This would change the wave length of the set and a double wave would result.—Ed.

A SIMPLE AND EFFECTIVE BLOW PIPE

A blow pipe is a piece of apparatus that should be in the hands of every experimenter, for it enables him to solder in places where it is impossible to employ a soldering iron. A simple and effective blow pipe may be made as follows:

Procure a conventional blow pipe from a jeweler or chemical apparatus supply house and also a piece of brass pipe ¼ inch in diameter. File a small hole in the brass pipe about three inches



from the end, of sufficient size so as to allow the insertion of the small end of the blow pipe, and arranging it to bring the ends of the tube and blow pipe flush as shown in the drawing. Solder around the blow pipe to prevent the leakage of gas.

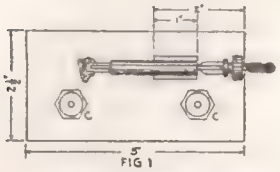
To use it, connect the open end of the ¼ inch pipe to a gas jet. The large end of the blow pipe should be bent outward. Pieces to be soldered should be carefully cleaned and soldering flux applied. The solder is then applied in small pieces. Light the gas and apply the mouth to the blow pipe. By blowing gently a small stream of flame will be secured, which will be of intense heat and readily melt the solder.

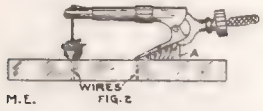
Contributed by

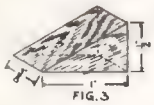
William D. Long.

THE COMPASS DETECTOR

This is the plan of a detector which I made and successfully used until I bought the one which I use now. It worked very satisfactorily with a silicon crystal and ought to be simple enough to make and yet efficient for any amateur who does not wish to invest any money in one. Unless an old school







compass can be found, the instrument fully justifies the investment of the eighteen cents which a new one would cost.

It is made as follows:

Having cut out the base, 5"x2½"x½", take a small block (a) of a non-splitting wood and shape as in Fig. 3. Divide the width of the base into three parts, as in Fig. 1, and mount the block on one line, as shown, with glue or finishing nails. Cut the two arms off the compass, one at three and the other at two inches from the joint. Flatten out the latter arm and secure to the top of the block, A. Cut a wooden plug, B, one inch long to fit tightly, beside a No. 14 copper wire, into the end of the three-inch compass arm and let it project ½" beyond the arm. Bend the wire to run through a hole in the plug and suspend over a cup for the crystal. This may be any small, conducting, saucer-shaped dish which can be fastened to the base. The binding posts, which are left out of Fig. 2 to prevent complication, may be obtained from the carbons of a couple of dry cells or better ones may be used. Connections should be made to the cup and to the flattened arm of the compass. Care should be taken to have the arm rigid and the small block unsplintered. To gilt the arm, varnish the base, and wax all wires used to pass wires through the base, would add greatly to the looks and efficiency. Oil, applied at the screw would aid adjustment.

Contributed by *Olin C. Krum.*

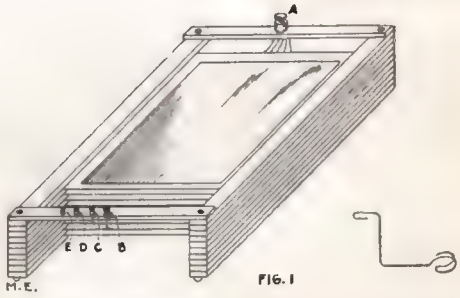
A ONE-INCH COIL CONDENSER

Many plans for sending condensers have been described recently, but very few of them take up little space, add to a station's appearance or are intended for small coils. The following fills all these requirements.

Nine 8 by 10 inch glass photographic plates are thoroughly cleansed, and on seven of them two sheets of tin foil 5 by 8 inches are shellacked in the usual manner, being careful to avoid all air bubbles.

Twenty hardwood strips are cut 13 inches by 1 inch by ¼ inch. Also two similar strips 10 inches long. At ½ inch from both ends of each strip a ½ inch hole is bored, being careful not to split the wood. The plates are then assembled as in Fig. 1, with a bare plate at the top and bottom for protection.

Connections are made by means of wires bent as shown in Fig. 2 and inserted between every other plate at opposite ends. This makes a total of four



leads at each end. The four at one end are connected at a binding post, while the four at the opposite end are connected to separate posts in the cross-pieces. See Fig. 1.

For a one-inch coil, shunt condenser posts, A and B, are used alone, while for a series condenser posts B, C, D, E, are connected together.

Contributed by

A. S. Van Deusen, Jr.

A CURIOUS HOOK-UP

The following interesting experiment is being sent to you, with the hope of publication in your valuable magazine, partly because the writer believes it may interest the experimenters who, after reading of it, may try it themselves, and partly for an explanation of its effects. Perhaps I have blundered upon some unknown prop-

erty of the body in regard to electromagnetic waves; but if already known I would be pleased to have it explained.

The experiment concerns the receiving hook-up. With a silicon detector, 75 ohm phone, single slide tuning coil wound seven inches of its length with bare copper wire and three inches in diameter, hooked up as per Fig. 1, and connected to an aerial 30 ft. high, 48 ft. long, 4 wires one ft. apart, I can hear Herald (WHB) all along the coil (very faintly at ends), strongest in center. I can also hear Brooklyn Navy Yard (NAH) all along the coil, strongest with all tuner wire in circuit. WHB is nine miles away, and NAH is six miles away.

So much for hook-up No. 1, which is an ordinary one. With the same aerial and instruments, hooked up as per Fig. 2, and with my finger pressed hard on the detector binding post which was unconnected, I heard WHB louder at a certain point on tuner (with about one-fourth the wire between aerial and slider) than I could at any point with hook-up No. 1; and, by moving the slider about one inch either way, WHB could be entirely tuned out. I also heard NAH louder with Fig. 2 than anywhere on tuner with No. 1 hook-up. NAH could be tuned out two inches either way from loudest point.

This hook-up would not work at all if I removed my finger from the binding post, so my body must have acted in some peculiar manner. Thinking it might be a ground through my body that made this hook-up work, I touched my other hand to the ground of the aerial switch, and was surprised to find that the signals were made fainter every time either aerial or ground blade was touched.

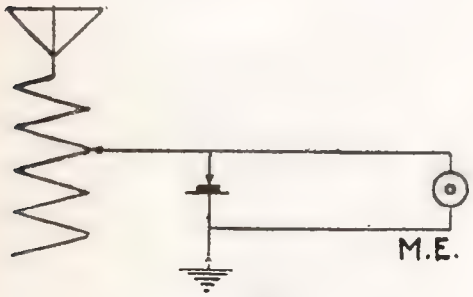


FIG. 1

I have consulted several friends regarding this hook-up, and it is new to all of them. Every hook-up I have ever seen had the detector connected in some way between aerial and ground. This hook-up has one detector binding post connected to tuner, and the other post is pressed by the finger; if the finger was taken from the post all signals ceased. Sharper tuning and louder signals are the advantages of the No. 2 hook-up. The detector had the same adjustment for both No. 1 and No. 2 hook-ups, so it could not be

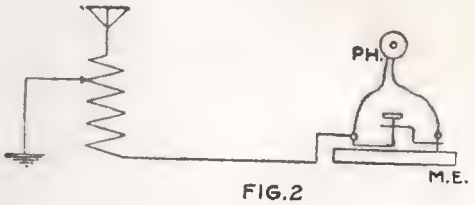


FIG. 2

because No. 2 had a better adjustment than No. 1.

With a variable condenser or other instruments connected up in various ways, still more surprising results may be obtained. I had only the simplest of apparatus to work with, but perhaps someone else with a more extensive command of instruments will give this hook-up a complete tryout, connecting up in every conceivable way, and discover some new principle of radio telegraphy.

Contributed by

Wm. F. Aufenanger.

Note.—If one terminal of a condenser of about 1 mfd., such as a Western Electric telephone condenser, be connected to the post which was touched by the finger, and the other terminal left unconnected, much the same effect should be noticed.—Ed.

IRON WIRE VS. GERMAN SILVER

In the May issue of *Modern Electrics* on page 137 was a description of a practical electric toaster, by Max Hagspiel. In this description he said to use No. 24 German silver wire. I found that stovepipe wire of about the same size would do just as well. This wire is cheaper and burns as long or longer than the German silver.

Contributed by

Raymond H. Wolfe.

A SENSITIVE GALENA DETECTOR

The majority of the detectors described in this magazine have consisted of a cup containing a piece of galena and a fine steel wire for the other contact. These detectors will give excellent results if care is used in adjusting.

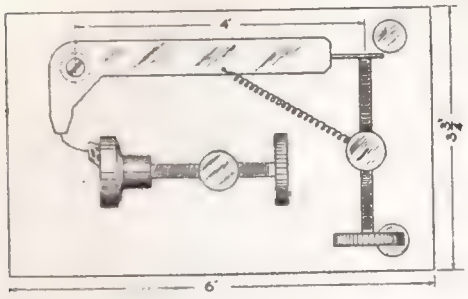


FIG. 1

A sensitive detector which has a wider range of adjustment, however, can be made by using a lever to adjust the piece of steel wire. In Fig. 1 a top view of a detector built on this plan is shown. A very slight turn of the screw which adjusts the lever will move the extremity of the wire a very short distance. The diameter of the knurled head helps to give a fine adjustment.

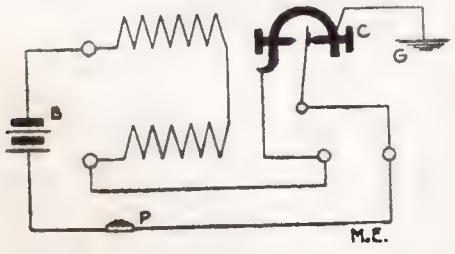
The galena may be fastened in the cup by means of Woods metal, which is made by melting lead, 2 parts; tin, 1 part; bismuth, 4 parts, and cadmium, 1 part, as described some time ago in this publication.

Contributed by

James Chapple.

A SUBSTITUTE FOR BUZZER TEST

One of the principal objections to the buzzer-test is the noise that the buzzer makes, which drowns out the sound in the receivers. To avoid this I used an old relay, employing the connections shown in the accompanying diagram. The noise of the relay's vibrating armature is practically nil and therefore it is possible to obtain a clear sound in the receivers.



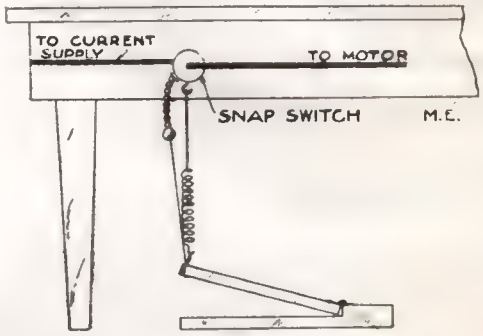
Contributed by

Alex Polson.

FOOT OPERATED SWITCH

Where a person wishes to run a rotary spark gap separate from the working of the aerial switch this is especially useful.

The accompanying is a diagram of a switch of my own construction, which is placed under the table and is worked by the foot. It is very simple to make and the diagram fully describes it.



Contributed by

Geo. S. Mason.

A CONNECTION BLOCK

The connecting device described below is designed to avoid the use of any nuts or springs. Upon consulting the drawing we find that is consists of a row of circular brass pieces eccentrically mounted upon a shaft.

Their surfaces are roughened and upon pushing the wire under one of the pieces and then pulling it back again, the eccentrics clamp the wire securely against the brass plate. These plates are about ⅛ inch thick and are arranged in a series of steps to accommodate different sized conductors.

Thus section "A" (Fig. 1) will clamp No. 10-16 wire most securely, while "B" and "C" are best suited to fasten Nos. 18-22 and 24-36, respectively.

In the main, the drawings are self-explanatory. However, we may explain

a few minor points. If solid brass rod cannot be obtained, it is possible to make a very acceptable substitute by taking a hollow tube of the required size, inserting a steel rod for a shaft and then holding the shaft securely against one side of the tube, fill the remaining space with lead. The details of this operation are left to the reader. Withdraw the

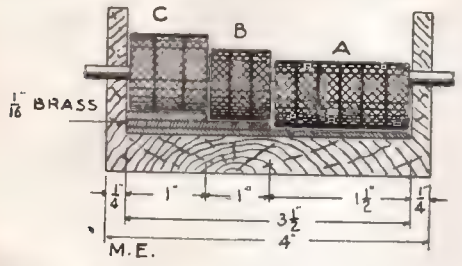


FIG. 1

shaft as soon as possible. Then cut the tube up into ⅛ inch rings, using a metal or hack saw.

The surface may be roughened by using a file and clamp arranged as shown in Fig. 2.

String the rings back on the shaft and assemble the complete instrument as shown in Fig. 1. The size of the base and of the uprights will depend upon the diameter and length of the eccentric,

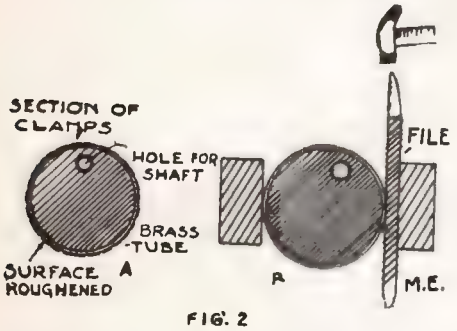


FIG. 2

and hence these details are not given. This device may be used only for a ground connector or the like, where several wires are run to one point.

Contributed by

Paul Horton.

WIRELESS A LA TELEPHONE

While listening in at the new radio station at the Los Angeles High School one night I thought I would try a new stunt, so after I got NPL, the government station at Point Loma, California, in tune, I called up one of my friends here in the city on the line telephone, with which the station is equipped. I asked him how he would like to listen to "NPL"; he said that he did not have time to go out into his station just then. I told him that he didn't have to do that, just listen. I held one of my wireless phones up to the line transmitter, and after a minute asked him how he got it. He told me that the quenched arc of "NPL" came in great over the line. I had just installed a new rotary and had not had a chance to find out how it sounded. Telling my friend to listen, I pulled off my aerial and started my rotary, turning the transmitter of the line phone towards the transmitting room, I asked him how he liked my new spark. He said that it sounded fine to him over the phone.

I think I will have to call this stunt "Wireless a la Telephone."

Contributed by

Ralph E. Henry.

A GOOD VARNISH AND INSULATOR

A good many amateurs would like to have a black varnish with which to paint their instruments, woodwork, etc., as black makes them shiny and neat looking, but few know how to make it up.

A very good formula for such a varnish, which is also a fine insulator, that was used successfully by the writer is herewith submitted: Liquid shellac, (white), 4 oz. bottle; aniline dye (black), 1 tablespoonful.

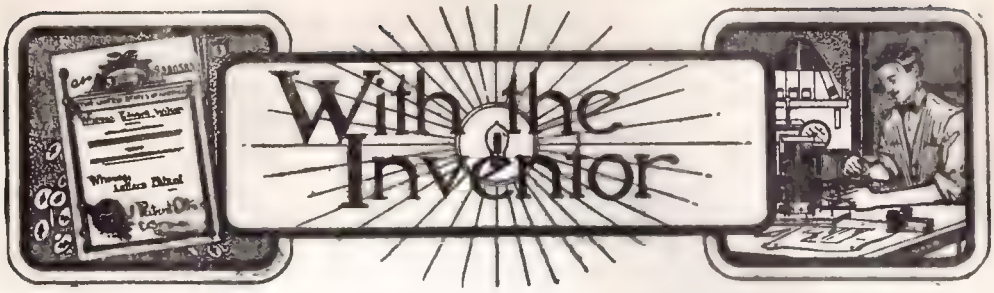
The shellac should be about as thick as when used for ordinary electrical work and the aniline dye *must* be soluble in *alcohol* only and may be obtained at any paint store. Mix and shake well.

The mixture, if made right, and when laid on with a soft brush, quickly, will produce a black shiny surface which presents a neat appearance. This varnish must be laid on quickly as it sets in a few seconds.

It may be used for woodwork, bases, tuner and loose-coupler windings and in many other ways, which will suggest themselves to the user, with good results. This mixture should be shaken each time it is used.

Contributed by

R. Woodward.



PATENTS FOR INVENTIONS*

By Laurence J. Gallagher

WHILE the subject of patents is of general interest, it is of particular interest to those who are engaged in the practice of the mechanical and electrical arts; such arts offer a wide field for the exercise of the inventive faculty, and it behooves a man to make the most of that faculty not only for the satisfaction which naturally follows the production of something new, but also because of the reward which, under certain conditions, follows such production. The ownership of a patent granted on an invention which is in demand is a valuable asset; in order to appreciate this fact, it is necessary to know the rights and liabilities of ownership; the underlying principles of such matters as well as a clear understanding of what the grant of a patent means to-day can best be had from a consideration of the development of the law of the subject. The law to-day in any case is the latest step in a series of changes which has been taking place since men first came together to form civilization; while the law changes to meet changing conditions, the purpose of the law is fixed. In considering patent law we turn to England to trace the development of the fundamental idea, since the principles of our own law are identical with those of English law; many legal rights possessed by citizens of this country have been defined by consideration of what the law in England was at the time the Constitution of this country went into effect.

The grant of a patent is the outgrowth of a system which had for its purpose the reward of those who engaged in trade at great risk and peril. Under early English rule every merchant who had made three voyages beyond the sea was given a title of dignity; later a merchant who introduced some new trade into the land, or who by his own industry brought some new engine into use in furtherance of trade, was granted a monopoly of that trade for a reasonable length of time in return for his labors. A monopoly is simply confining the sale of any merchandise or commodity to one person or to a number of persons; it could hardly be held unjust to say to a man, "If you risk your life and goods by going to a distant country and learning a new art or trade and will introduce it into this country the King will reward you with a monopoly of it until the people may learn it"; the grant of such a monopoly took the form of an open letter from the King, hence the term "letters patent."

It was the abuse of the practice of rewarding traders that led to the passage of a law clearly defining the grant of monopolies; the abuse came about in this way: Since a monopoly of any commodity gave the owner thereof great power and enabled him to impose great hardship on the great mass of the people, since the commodity could only be bought from him, the Sovereigns were not slow to realize that great sums could be had from the sale of monopolies; therefore, instead of conferring the monopoly on the merchant or trading company who was to

*Copyright, 1913, by Laurence J. Gallagher.

enjoy it as a reward for something done the public, the Sovereigns sold monopolies by the score to their favorites; the grant of a monopoly even in a proper case was merely a favor on the part of the Sovereign who was supposed to have in mind the commercial growth of the country; there was no legal right on the part of the subject, even in a proper case, to such a grant, and it was for this reason that the abuse so easily crept in. Macauley in his History of England sets forth at length the commodities embraced in monopolies which were sold by Queen Elizabeth, such commodities including the ordinary necessities of life.

The sale of monopolies was, then, the abuse of the grand principle embodied in the reward accorded to the trader and the importer of something new; the courts of the times upheld the rights of the owner of such a reward, acknowledging the right of the Sovereign to grant such, but held that monopolies which had been sold by the Sovereign were void; in one case (the Cloth-workers of Ipswich) the court said, that after a monopoly on a new trade had expired "the King cannot make a new grant thereof, for when a trade has become common and others have been bound apprentices to that trade, there is no reason why they should be forbidden to use it"; the right of the Sovereign to grant such rewards was always acknowledged and therefore formed part of the Common Law of England.

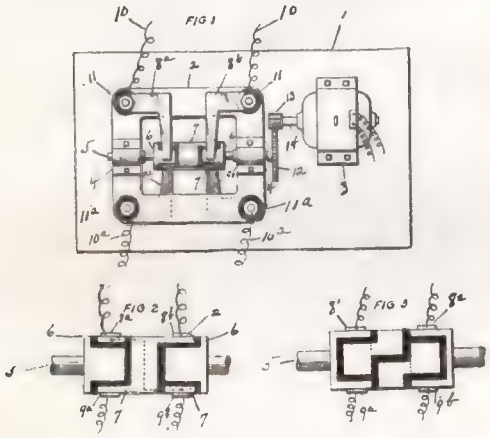
In 1623, during the reign of James I, the famous Statute of Monopolies was passed by Parliament and approved by the King, which statute is the source of the present-day patent law of England and of the United States. The statute declared what the courts had always held to be proper practice—that certain liberties granted by King John in Magna Charta at Runnymede in 1215 were no longer to be taken away at the will of the Sovereign; hence the statute was, as the books put it, declaratory of the Common Law since no new legal rights were created; as a matter of fact, it placed a limitation on the power of the Sovereign, since the grant of a monopoly, even in a proper case, was a matter of favor and not of right. Specifically the statute provided that all grants of monopolies then existing were void, excepting grants made to the first and true inventor or inventors for the working or selling of a new manufacture; such grants were to be of twenty-one years' duration and in the future were to extend over fourteen years. Certain monopolies were particularly mentioned as not being affected by the statute, among them being patents covering the art of printing, the art of making saltpeter, the art of making glass, and the art of making iron ore and forming it into bars.

Before the passage of the Statute of Monopolies the inventor had to struggle to protect what was new and after the passage of the statute the public was obliged to contend for what was old and well known in order to keep such to themselves; in the effort to protect inventions legislation went to such an extent that abuses, different from those which it was the purpose to correct, followed. An inventor who had claimed more than one invention in his patent, or who had claimed more than he had invented, was permitted to correct his patent, even after it had been declared void, in order to save what was really his invention; the patentee of a void patent was even permitted to have his patent declared valid if he could produce proof that at the date of his patent he believed himself to be the first inventor of what was set forth in his patent and if the patented article had not previously been generally and publicly used. How such abuses were corrected is of little importance to us; such facts are set forth merely to illustrate what had been done before our own lawmakers and judges took up the patent privilege and to set forth practices and results which guided them in framing and interpreting laws on such privileges.

Recent Electrical Patents

A SIMPLE, inexpensive and durable transformer of electricity is described and shown by John W. Davis, of St. Clair, Miss., in his Letters Patent No. 1,056,739, relating to an improvement in commutators. Fig. 1 is a plan illustrating the practical application of the invention, and Figs. 2 and 3 elevations of the commutator in two positions.

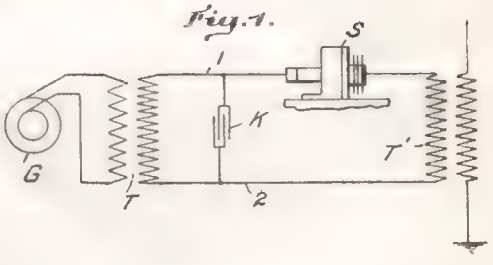
In operation, when it is desired to change a direct to an alternating current, the current is carried into the device by means of the wires, 10-10, and motion imparted to the shaft, 5, by means of the gear-wheels, 12 and 13, and the motor, 3. The segments, 6-6, are so constructed in form and so positioned on the shaft,



5, that when the brushes, 8a-8b, are in contact therewith the current passes directly through said segments to the companion brushes, 9a-9b; while the segments, 7-7, are so constructed in form and so positioned on the shaft, 5, that when the brushes, 8a-8b, are in contact therewith the current passes through said segments from the brush, 8a to the brush 9b, and from the brush 8b to the brush 9a. The revolution of the shaft, 5, causes the segments to revolve and the segments, 6-6 and 7-7, are successively brought into contact with the brushes, 8a-8b and 9a-9b, and the current passes from the device through the brushes, 9a-9b, and the wires, 10a-10b, as an alternating current, the frequency of alternation being controlled by the frequency of revolution of the shaft, 5, the speed of the shaft being regulated by any suitable gearing or by a rheostat attached to the motor. If the change is to be made from an alternating to a direct current the alternating current is carried into the device through the wires, 10-10, and the operation of the commutator is the same as above described for commutating the direct current.

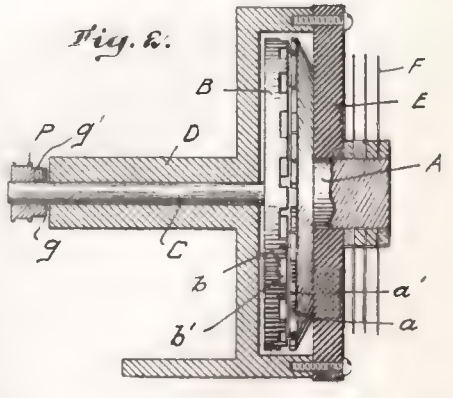
THE production of regulable tone-effects in the operation of wireless telegraphy is the object set forth in

Fig. 1.



two patents granted to Melville Eastham, of Cambridge, Mass., both assigned to Clapp-Eastham Company, of the same place. No. 1,056,892 is for the apparatus, and No. 1,056,893 for the method,

Fig. 2.

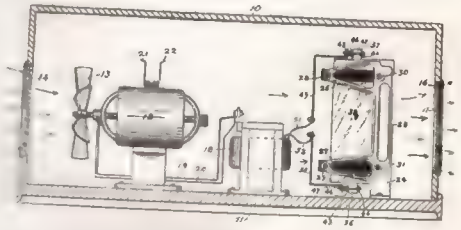


and in so far as the present synopsis is concerned, they may be treated as identical, Fig. 1, diagrammatically represent-

ing parts of a wireless telegraphic circuit and Fig. 2, showing in sectional diagram details of the spark gap device S. G is an alternating current generator set, including step-up transformer, T. The circuit which is excited by the transformer, T, comprises wires, 1 and 2, capacity, K, inductance T' and spark gap device, S, represented by two disks, A and B; B being mounted on shaft, C, to rotate in bearing, D, driven by pulley, P; disk, A, being mounted in the insulating plate, E. Adjustment of disks, A and B, is provided for by securing pulley, P, to shaft, C, by set screw, g'. The face, g, may be held against the housing by leading the driving belt from the pulley, P, at a slight angle. The plate, A, has external fins, F, for heat-radiation. Each disk is milled to form salient sectors, a, on the disk, A, and b, on the disk, B. The circumferential arc subtended by a sector, a or b, is less than that subtended by an interval, a' or b', between two salient sectors. The sector-disk, B, is rotated at such speed that each salient sector, b, passes an opposite sector, a, with high frequency as contrasted with the generator-frequency, say 600 times a second. If the circuit is adapted to charge the condenser about 18,000 times per second the operation of the train interrupting devices will produce 600 train groups per second, with 15 discharges per group, on the average, assuming the durations of train groups and the inactive intervals between them to be approximately equal. The rate at which the train groups occur can be regulated by regulating the speed of rotation of the disk, B. The shape of the salient sectors, a and b, insures such separation along the entire length of each sector-edge as will produce spark discharge interruptions without fail. As the approaching edges of sectors on the two disks are approximately parallel when sparking distance is reached, there will be no leading point where discharge will be predetermined, therefore the whole heat-conductive mass of each sector is efficient to prevent vaporization of metal and the formation of an arc, which is not only destructive of apparatus but interferes with the quick quenching of spark-oscillations.

Note.—This is the "Hitone" gap advertised by the Clapp-Eastham Co., and should be particularly interesting to our "wireless" readers.—Ed.

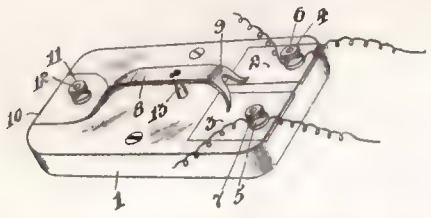
SIMPLE means for Ozonizing air by the use of an ordinary domestic electric light circuit are set forth by Siegfried Held, of Chicago, Ill., in Patent No. 1,056,789, the accompanying view representing a sectional elevation of the apparatus, in which 10 designates the casing resting upon a base, 11, on which is mounted an electric motor, 12, which drives a fan, 13, drawing air from the opening, 14, provided with a screen, 15. The opposite end of the casing is also provided with an opening, 16, and screen, 17. A transformer, 18, is connected to the motor, 12, by conductors,



19 and 20. 21 and 22 are the conductors of the actuating circuit. 23 designates the electrode frame which includes parallel uprights, 24, provided with upper and lower bracket arms, 26 and 27, the upper ones, 26, being connected by fibre rod, 28, and the lower by fibre rod, 29. 30 and 31 are also fibre rods between the uprights. Two groups, 36 and 37, of opposed electrodes are supported in the frame, and plates of glass, 38, are interposed between them. The transformer is connected with the electrodes by means of the conductors, 49-51 and 50-52. The air is forced through the spaces between the electrodes, and glass plates, and is thus ozonized before delivery through the opening, 17. The claims are for minor details of construction whereby the electrodes, etc., may be removed and replaced for cleaning; their number increased or diminished according to required capacity; the apparatus being adapted for shipment and use by persons other than skilled electricians.

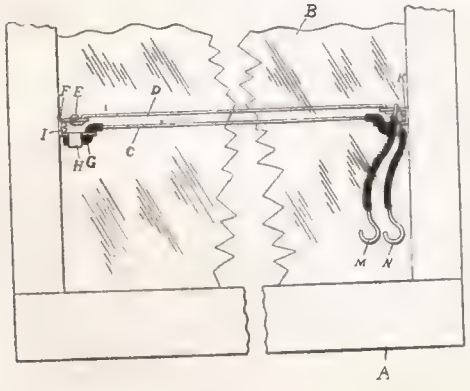
A SIMPLE inexpensive automatic fire alarm device operated by an abnormal increase of temperature is shown in the accompanying perspective

view taken from Letters Patent No. 1,057,784 issued to William and Frank Topp, of Granby, Quebec, Canada. 1 is the base formed of insulating material having plate contacts, 2 and 3, set therein provided with screws, 4 and 5, turn-



ing on correspondingly threaded pins, 6 and 7. 8 is a spring contact having forked end, 9, (to contact with the plates, 2 and 3), projecting from plate, 10, provided with thumb screw, 11, turning on threaded pin, 12. 13 is a post of fusible material, preferably a fusible metal, introduced between base, 1, and the underside of spring contact, 8, and of sufficient strength to normally counteract the spring of said contact, 8, and hold said forked end, 9, from engagement with the contacts, 2 and 3. On sufficient increase of the temperature the said post, 13, will melt and thus permit the forked end, 9, to engage the contacts, 2 and 3, thereby closing the electric circuit in which suitable alarm devices are interposed in the manner well known in the art,—the present invention relating primarily to the circuit closer shown.

SWATTING the fly is rather a crude method of extermination as compared with electrocution. Taking ad-



vantage of the well-known propensity of flies to seek the light, Frank D. Warren, of Colorado Springs, Colorado, has devised a simple, cheap and apparently effective device for giving them their quietus, and has procured a patent therefor, No. 1,058,680. This device consists of two bars, C and D, charged with electricity of sufficient intensity to electrocute a fly crawling across the said bars and thereby closing the circuit. The bars, C and D, are strung across the inner surface of the window glass, B, in such manner as to intercept the passage of the flies and close enough to the window glass to allow the flies to crawl over the said bars. The end, E, of bar, D, is secured to the bracket, F, by being laced through holes in said bracket and then clinched. The end, G, of bar, C, being insulated, passes through a hole in bracket, F, and is gripped by downwardly extending flanges, H, integral with bracket, F, said flanges being adapted to clamp the insulation of the said bar, C, by being bent over upon it. Bracket, F, is placed in contact with the window glass, B, and secured to the window sash, A, by means of a screw, I. Bars, C and D, are secured at the opposite side of the window sash, A, by means of a bracket, K, similar to bracket F. The free ends, M and N, are connected to the positive and negative poles of a battery or induction coil adapted to give a current of the required intensity.

A SIGNALLING device for automobiles, motor boats, etc., adapted to temper the sound to the requirements of use is the subject of Patent No. 1,057,752, issued to the Dean Electric Co., of Elyria, Ohio, as the assignee of the inventor, Ray H. Manson. Where the vehicle is traveling at a low rate of speed, a signal of a soft tone may be used to give the necessary warning of the approach of the vehicle; in fact, a loud signal is undesirable, particularly upon busy thoroughfares. On the other hand, on country roads or wherever the vehicle is approaching rapidly, it is desirable to give a signal of a more sharp and penetrating nature, in order to give a more distant warning.

As shown in the diagram, the sound producer consists of a device similar to a common buzzer the armature of which strikes a pin, 4, attached to a diaphragm, 2, which projects the sound directly out

through the horn or first through the bent portion of the horn tube, depending upon the position of the vane, 29. The vane is shown in its normal position. When the push button is depressed just sufficiently to connect springs, 20 and 21, the sound passes first through the bent tube and then out the horn producing the softer tone. If the button is depressed all the way the solenoid, P,

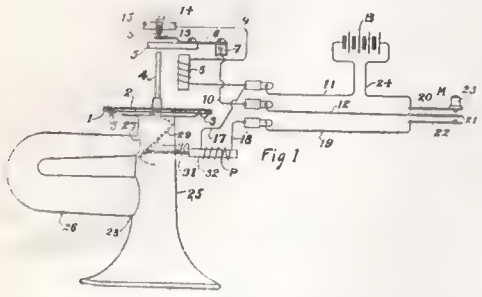
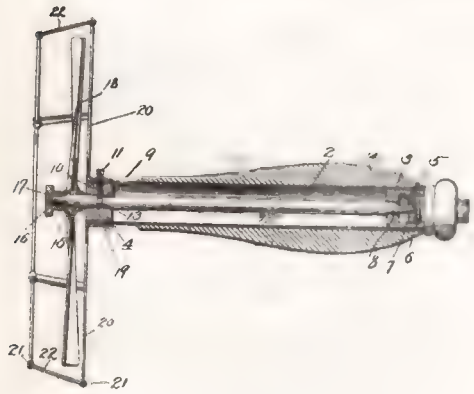


Fig 1

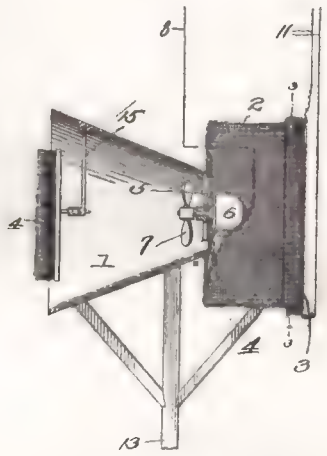
moves the vane through an angle of about 45° and allows the sound to go straight out, thereby producing the loud tone.

THE specific construction of what may be designated as a portable hand fan, designed more particularly for use in bath rooms and houses, tonsorial parlors, etc., where it is necessary or desirable to move and manipulate a fan, is the subject of the invention of George



H. Tuttle and Fenton B. Fleming, of Lincoln, Neb., as set forth in their Letters Patent No. 1,058,278, the accompanying view representing a sectional eleation of the same. It simply consists of a fan, the shaft of which passes through the handle, lengthwise, and is then connected to and driven by a flexible shaft attached to a fan motor or other suitable source of power having a fixed location in a room or apartment, and the fan may be conveniently held in the hand and moved from point to point as occasion demands.

IN the crusade against the house fly and other winged pests many expedients have been resorted to with various degrees of success, the latest device of this character being that invented by Samuel N. Edgar, of Lauder, Wyoming, who utilizes electricity to catch and then electrocute them, as per Letters Patent No. 1,055,620. The accompanying figure represents a sectional elevation of

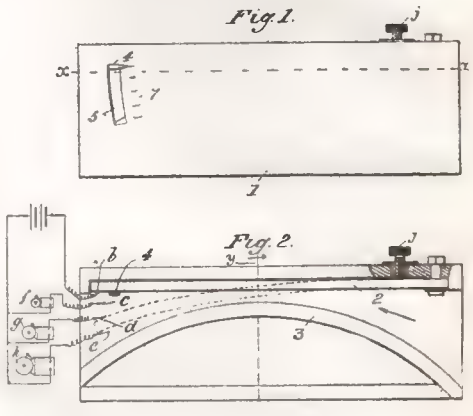


the trap, which comprises a funnel, 1, opening into a cylindrical screen trap, 2. The rear end of the cylinder, 2, is closed by a circular head, 3, also of wire gauze, said head being detachably fitted upon the cylinder, 2, the screen having a rim, 4, of hard rubber, or other suitable insulating material. The funnel carries at its rear end a suitable spider, 5, in which is journaled the shaft of an electric motor, 6, carrying a fan, 7. The motor is included in an electric circuit, 8, in which is arranged a switch, the wires being connected to an ordinary wall socket. The wire gauze of which the cylinder head, 3, is formed is included in a circuit, 11, also connected to a wall plug. 13 represents any form of support. To enable the device to be used after dark in collecting flies from walls, ceilings and other places where they

may have gathered a detachable brush, 14, is adapted to be connected to a suitable bracket, 15, carried within the funnel, 1, the brush projecting slightly beyond the mouth of the funnel.

After the motor has, through the operation of the fan, collected a large number of flies within the receptacle, 2, the motor is cut out. Current is then passed through the screen, 3, and as the flies will collect upon said screen they will be incinerated. The fine gauze wire of which said screen is formed will become incandescent, and all of the flies in the receptacle will be attracted to said screen, instead of trying to escape through the open end.

APPARATUS for indicating the proximity of Icebergs at Sea, invented by Willard G. Day, of Baltimore, Md., is based on the well-known fact that when one side only of a strip of some flexible material such as metal or hard rubber, is suddenly subjected to a cooling medium, the plate will warp, and will not regain its original shape until the entire body is again brought to a uniform temperature. Fig. 1 is a top view of the apparatus, and Fig. 2 a similar view with top removed to disclose the interior. 1 is a box formed of non-heat-conducting substance, such as wood, secured in an exposed position on a vessel, with its forward end toward the bow, and open at its ends. Extending longitudinally in the box, and secured closely to one side thereof and at one end, is a straight strip, 2, preferably of hard rubber; and between said strip and the other side of the box is a partition, 3, having a convex surface opposed to the strip, 2. This partition serves to direct the current of air entering the box against the exposed or inner surface of the strip, 2. Fastened to the free end of strip, 2, is a metal plate, b, which together with three independent pins, c, d and e, when the strip is sufficiently bent, will close an electric circuit in which there are bells, f, g, and h. Adjustment of strip, 2, with respect to the pins, c, d, and e, can be effected by screw j. Supposing the strip, 2, to have a uniform temperature throughout and in consequence straight, as shown by the full lines in Fig. 2, and the ship were suddenly to enter a body of air which, due to the proximity of ice, would have a temperature considerably lower than that of the strip, 2, the air forced by the velocity of the vessel through the box, 1, would cool the exposed surface of the strip, 2, and before the strip could be equally chilled throughout its mass, it would buckle, or rather be inwardly curved as shown by the dotted lines in Fig. 2; and the plate, b, coming in contact with the pin, c, the first electric circuit would be closed and the bell f.



therein sounded. In the continued advance of the vessel, and a further reduction in the temperature of the air, the other pins, d and e, would be successively brought into the closed circuit, and the second and third bells, g and h, be sounded and indicate increasing danger. If desired, a visual signal can also be employed, and this could be arranged by providing the strip, 2, with a pointer, 4, arranged to protrude through the slot, 5, in the top of the box, together with a scale, 7, as shown. The patent is No. 1,057,807.

THE ACERRIMA RADIANS SODALITAS

The wireless amateurs of McKeesport, Pa., formed a new club called Acerrima Radians Sodalitas.

The following officers were elected: Hunter F. Lohman, president; George West, vice-president; W. Niman Ivey, secretary; Earl A. Bradshaw, treasurer; John Hunter, chief operator.

Form 737

DEPARTMENT OF COMMERCE
BUREAU OF NAVIGATION
RADIO SERVICE

INTERNATIONAL RADIOTELEGRAPHIC CONVENTION

LIST OF ABBREVIATIONS TO BE USED IN RADIO COMMUNICATION

ABBREVIATION	QUESTION.	ANSWER OR NOTICE.
PRB	Do you wish to communicate by means of the International Signal Code?	I wish to communicate by means of the International Signal Code.
QRA	What ship or coast station is that?.....	This is.....
QRB	What is your distance?.....	My distance is.....
QRC	What is your true bearing?.....	My true bearing is.....degrees.
QRD	Where are you bound for?.....	I am bound for.....
QRF	Where are you bound from?.....	I am bound from.....
QRG	What line do you belong to?.....	I belong to the.....Line.
QRH	What is your wave length in meters?.....	My wave length is.....meters.
QRJ	How many words have you to send?.....	I have.....words to send.
QRK	How do you receive me?.....	I am receiving well.
QRL	Are you receiving badly? Shall I send 20? • • • ▬ • for adjustment?.....	I am receiving badly. Please send 20. • • • ▬ • for adjustment.
QRM	Are you being interfered with?.....	I am being interfered with.
QRN	Are the atmospherics strong?.....	Atmospherics are very strong.
QRO	Shall I increase power?.....	Increase power.
QRP	Shall I decrease power?.....	Decrease power.
QRQ	Shall I send faster?.....	Send faster.
QRS	Shall I send slower?.....	Send slower.
QRT	Shall I stop sending?.....	Stop sending.
QRU	Have you anything for me?.....	I have nothing for you.
QRV	Are you ready?.....	I am ready. All right now.
QRW	Are you busy?.....	I am busy (or: I am busy with.....). Please do not interfere.
QRX	Shall I stand by?.....	Stand by. I will call you when required.
QRY	When will be my turn?.....	Your turn will be No. .....
QRZ	Are my signals weak?.....	Your signals are weak.
QSA	Are my signals strong?.....	Your signals are strong.
QSB	Is my tone bad?..... Is my spark bad?.....	The tone is bad. The spark is bad.
QSC	Is my spacing bad?.....	Your spacing is bad.
QSD	What is your time?.....	My time is.....
QSF	Is transmission to be in alternate order or in series?	Transmission will be in alternate order.
QSG	.....	Transmission will be in series of 5 messages.
QSH	.....	Transmission will be in series of 10 messages.
QSJ	What rate shall I collect for.....?	Collect.....
QSK	Is the last radiogram canceled?.....	The last radiogram is canceled.
QSL	Did you get my receipt?.....	Please acknowledge.
QSM	What is your true course?.....	My true course is.....degrees.
QSN	Are you in communication with land?.....	I am not in communication with land.
QSO	Are you in communication with any ship or station (or: with.....)?	I am in communication with.....(through .....).
QSP	Shall I inform.....that you are calling him?	Inform.....that I am calling him.
QSQ	Is.....calling me?.....	You are being called by.....
QSR	Will you forward the radiogram?.....	I will forward the radiogram.
QST	Have you received the general call?.....	General call to all stations.
QSU	Please call me when you have finished (or: at ....o'clock)?	Will call when I have finished.
*QSV	Is public correspondence being handled?.....	Public correspondence is being handled. Please do not interfere.
QSW	Shall I increase my spark frequency?.....	Increase your spark frequency.
QSX	Shall I decrease my spark frequency?.....	Decrease your spark frequency.
QSY	Shall I send on a wave length of.....meters?	Let us change to the wave length of..... meters.
QSZ	.....	Send each word twice. I have difficulty in receiving you.
QTA	.....	Repeat the last radiogram.

*Public correspondence is any radio work, official or private, handled on commercial wave lengths.

When an abbreviation is followed by a mark of interrogation, it refers to the question indicated for that abbreviation.

11-6008

Form 773

DEPARTMENT OF COMMERCE
RADIO SERVICE

INTERNATIONAL MORSE CODE AND CONVENTIONAL SIGNALS

TO BE USED FOR ALL GENERAL PUBLIC SERVICE RADIO COMMUNICATION

1. A dash is qqual to three dots.
2. The space between parts of the same letter is equal to one dot.
3. The space between two letters is equal to three dots.
4. The space between two words is equal to five dots.

A • —	
B — • • •	
C — • — •	
D — • •	
E •	
F • • — •	
G — — •	
H • • • •	
I • •	
J • — — —	
K — • —	
L • — • •	
M — —	
N — •	
O — — —	
P • — — •	
Q — — • —	
R • — •	
S • • •	
T —	
U • • —	
V • • • —	
W • — —	
X — • • —	
Y — • — —	
Z — — • •	
Ä (German) • — • —	
Á or Å (Spanish-Scandinavian) • — — • —	
CH (German-Spanish) — — — —	
É (French) • • — • •	
Ñ (Spanish) — — • — —	
Ö (German) — — — •	
Ü (German) • • — —	
1 • — — — —	
2 • • — — —	
3 • • • — —	
4 • • • • —	
5 • • • • •	
6 — • • • •	
7 — — • • •	
8 — — — • •	
9 — — — — •	
0 — — — — —	

Period	• • — — • •
Semicolon	— • — • — •
Comma	• — • — • —
Colon	— — — • • •
Interrogation	• • — — • •
Exclamation point	— — • • — —
Apostrophe	• — — — — •
Hyphen	— • • • • —
Bar indicating fraction	— • • — •
Parenthesis	— • — — • —
Inverted commas	• — • • — •
Underline	• • — — • —
Double dash	— • • • —
Distress Call	• • • — — — • • •
Attention call to precede every transmission	— • — • —
General inquiry call	— • — • — — • —
From (de)	— • • •
Invitation to transmit (go ahead)	— • —
Warning—high power	— — • • — —
Question (please repeat after .....)—interrupting long messages	• • — — • •
Wait	• — • • •
Break (Bk.) (double dash)	— • • • —
Understand	• • • — •
Error	• • • • • • • •
Received (O. K.)	• — •
Position report (to precede all position messages)	— • — •
End of each message (cross)	• — • — •
Transmission finished (end of work) (conclusion of correspondence)	• • • — • —

19—5049

THE DANGERS OF HIGH-TENSION ELECTRIC CURRENTS*

In reference to the dangers of electric currents, and aid in case of accidents by those of high tension, the principles enunciated by Kübler were as follows:

(1) In order to correct the errors in ordinary belief on the subject, one must emphasize the difference between (a) the danger from stationary objects charged with high electric tension, and (b) that arising from electric machines in motion.

(2) Every large amount of concentrated energy is dangerous; therefore the concentration of electrical energy in or on any object is more so. The greater the amount of energy stored, the more powerful the effect and the greater the danger. In order to cause an inflammation of the eye, there is necessary only an amount of energy equal to one gram centimeter per second. It is therefore wrong to make a difference between high tension and low tension currents, as regards the danger therefrom.

(3) The danger that can be caused by an accident is less, according as the technical devices are controlled by the construction; that is, the better the constructor is enabled to exclude the necessary conditions for an accident. As the electrical engineer has, in this particular, better prior conditions than the constructor in most other technical fields, electrical constructions are, if carried out by experts, less dangerous than any others. The statistics of accidents show, as far as is possible in their present shape, the truth of this statement; and the experience of all practical men will also confirm it.

(4) As far as any danger is left, it is therefore characteristic, and the degree of danger is to be recognized as (a) the uncertainty of the electric current and the impossibility of recognizing its presence by any of our senses; (b) the shameful lack of understanding of the most simple electric processes on the part of the great majority of people, including those of the educated classes.

In regard to (a) any diminution of the danger by artificial means is already partly possible, but most certainly partly unattainable. With reference to (b) improvement is only a question of time, as even superficial comparison of the growing generation with the grown-up one proves.

(5) The degree of danger is also shown by the fact that neglecting those accidents which are proved to be the result of false electric construction, there remain only those which are caused by great carelessness on the part of the one injured.

(6) Official attempts to take action in the matter are justified only where public interests are endangered by electric devices; and should even in these cases be limited to compelling proper construction in the sense of (4a). On general principles the proposed revision of the laws in this particular is false.

(7) Unjustified frequenting of electrical plants should, in the case of these, as well as others, be punished with special severity.

(8) The comparatively few cases of death occurring in the case of accidents from high tension currents is a frequent source of surprise to physicians called in for aid, and they have very little experience in the matter. It is to be hoped that in this particular all physicians should be specially instructed: this would lead to the resuscitation of many cases which would otherwise be considered as hopeless.

* From a paper by Prof Kübler, of Dresden.

ANOTHER ELECTRIC FAKE

We are advised by one of our readers in Maryland that a certain smooth tongued individual is visiting electricians and trying to interest them in a Magic silver plating solution, three pints of which he sells for something like $25, or as much as he can get from his prospective victim. Our correspondent further advises us that upon analysis the solution is found to contain nothing but nitrate of mercury and that the value of the three pints of solution does not exceed 75c.

If this is correct, we would advise our readers to be on the lookout for this person, and be careful not to purchase silver plating solution which is not manufactured by a reputable concern.

ELIMINATION OF INTERFERENCE BETWEEN WIRELESS STATIONS AND POWER AND TELEPHHONE CIRCUITS

From time to time I have noticed various queries, asking for methods of preventing wireless sending stations from affecting neighboring telephones, but up to date have, seen no very satisfactory method of doing same described, short of changing the position of the antenna in relation to that of the telephone wires.

I experienced the same trouble, and it was impossible to use our telephone when my sending set was being operated. But through the assistance of my friend, Mr. Herb. Rodd, of Cleveland, Ohio, I have been able to overcome the difficulties. The method is as simple as it is effective, and is one that, as I see it, all telephone companies could adopt, and should adopt, in cases where their subscribers' 'phones are "knocked out" by the wireless sending stations, and this could be done at very small expense.

The method is exactly similar to that followed in protecting power circuits from high potential surges, due to the operation of the transmitting sets, viz.: connecting two condensers in series across the line and grounding the central point. I have not taken up the matter with the Underwriters, but I presume it would be necessary to use condensers having a capacity of not less than ½ mfd. each. My friend advised me that it might be necessary to vary the capacity of the condensers used, as it might affect the ringing of the bells on party line 'phones, but I have had no trouble in this regard. He also recommended that the carbon blocks in the lightning arrester be removed, but I have not done so, and get the same good results.

It may be necessary to get permission from the telephone company to attach this device to their lines, but I do not think they will object, as it will be as much to their benefit as to anyone's. I have never noticed any bad effect on the operation of the 'phone, due to this device, except as follows:

In the case of the local telephone company, they have allowed the power company to string their high potential arc circuit wires on a low cross arm of their poles (a very foolish and dangerous practice), and at night a humming may be noticed in the telephone receiver. When the protective condenser is connected to line, this humming is increased to nearly a roar, but it is far easier to hear a person's voice through this roar than when no protective condenser is employed, and the sending station is in operation. It would be an excellent plan to connect the condenser to the line through a double pole, single throw switch, thereby permitting the condenser to be thrown out of circuit at night when the transmitting set was not being operated. Of course this humming may not be noticed in all telephone systems.

Incidentally, the above suggests another trouble of the wireless enthusiast. It oftentimes happens that the antenna is adjacent to the high tension wires of an arc light or other circuit, and at night it is almost impossible to receive any except very strong signals. I have had this trouble, too, but not very seriously, as my wires are not parallel to the high tension line. I noticed that the humming due to this seemed to "follow" the 110 v. A. C. lines coming into my station, and that if I disconnected these wires at the point where they entered the house, the humming would immediately cease. Now method No. 1 to prevent this disturbance is to disconnect all power lines while receiving. That is, to disconnect them somewhere near the operating table, for the power circuit wires are usually more or less near the wires leading to the receiving set.

I use a loose coupled receiving set, and found that the humming could be eliminated by touching "ground" with my finger, and signals would not be decreased in the least. So method No. 2 is to place a "ground plate" on the floor, and when receiving, place the foot upon it. (It is hardly advisable to keep your foot on it when you send, as you will discover by experience!)

(*Continued on page* 890)

FLYING SPARKS

STRIKE BROKEN

Master of the House—"See here, Mary Ann, where's my dinner?"

Slavey—"Theer ain't agoin' to be no dinner, if you please, sir."

"What's that! No dinner?"

"No, sir. The missus came 'ome from jail this afternoon, an' ate up heverything in th' 'ouse!"—*Cleveland Plain-Dealer.*

HAD HIS NUMBER

A Philadelphia lawyer and connoisseur was describing some of his experiences in search of curios. "I once entered a shop," he said, smiling, "and the salesman pointed out to me a dilapidated chair. 'That there chair, sir,' he said, impressively, 'belonged to Louis Crosseye, King of France.' 'Louis Crosseye?' said I. 'Why, there's no such person.' 'Oh, yes, there is, sir,' said the salesman, and he showed me a ticket marked Louis XI.' "—*Liverpool Post.*

SAD IGNORANCE

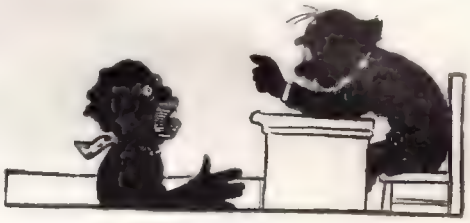
Assistant District Attorney Clark was conducting a case in the Criminal Court. A large, rough-shouldered negro was in the witness chair.

"An' then," said the witness, "we all went down in the alley, an' shot a few craps."

"Ah," said Mr. Clark, swinging his eyeglass impressively. "Now, sir, I want you to address the jury and tell them just how you deal craps."

"Wass that?" asked the witness, rolling his eyes.

"Address the jury, sir," thundered



Mr. Clark, "and tell them just how you deal craps."

"Lemme outen heah," said the witness, uneasily. "Firs' thing I know this gemman gwine ask me how to drink a sandwich."—*San Francisco Argonaut.*

GREAT CLIMAX

"Did the play have a happy ending?"

"You bet it did. Someone in the gallery hit the villain square in the face with a tomato."—*Houston Post.*

The Wireless Station and Laboratory Contest is continued from month to month. The best photograph, each month is awarded a First Prize of Three (3) Dollars; second best, Two (2) Dollars; third best, One (1) Dollar. If you have a good photograph of your station or laboratory, send it in. If you haven't one, take one, or have it taken.

PLEASE NOTE THAT THE DESCRIPTION OF THE STATION MUST NOT BE LONGER THAN 250 WORDS, AND THAT IT IS ESSENTIAL THAT ONLY ONE SIDE OF THE SHEET IS WRITTEN UPON. SHEET MUST BE TYPEWRITTEN OR WRITTEN BY PEN. IF TYPEWRITTEN, USE DOUBLE SPACING. DO NOT USE PENCIL. NO DESCRIPTION WILL BE ENTERED IN THE CONTEST UNLESS THESE RULES ARE CLOSELY ADHERED TO.

It is also advisable to send two prints of the photograph (one toned dark and one light) so we can have the choice of the one best suited for reproduction.

This competition is open freely to all who may desire to compete, without charge or consideration of any kind. Prospective contestants need not be subscribers for (the publication) in order to be entitled to compete for the prizes offered.

FIRST PRIZE

My wireless station is shown in the accompanying view.

The aerial is 125 feet long, 70 feet high at one end and 40 feet at the other. I use the T type with four wires on 12 foot spreaders. My receiving consists of a loose-coupler with a sliding primary, eleven-plate rotary variable condenser, galena detector, inductance and

WINNE STATION

loading coils and a pair of 3000 ohm phones.

With this set I have received from 800 to 1,000 miles under normal conditions.

The sending instruments consist of a one-half kw. transformer, glass plate condenser, helix, which cannot be seen; zinc spark gap and key with ¼ inch tungsten contacts. I also have a hot-wire ammeter, which works very well.

I think *Modern Electrics* is a very good magazine and recommend it very highly.—*Geo. L. Winne, New York.*

SECOND PRIZE

Here is a flash light of my radio outfit with which I communicate with the University of North Dakota.

I use a ½ kw. transformer and electrolytic interrupter, which I have remodeled, using a glass tube instead of the porcelain one. Sending condenser is shown beside the transformer in the picture, while the spark gap is on the helix base, the key is beside the fuse switch, only a small portion of it being visible. The home-made receiving transformer is at my right in the box, only the slider, rod and a little of the primary being visible. The potentiometer, detector, battery, switch, and fixed and variable condensers are visible. I rewound the potentiometer putting on resistance wire instead of

using the carbon rod. The phone I employ is a 1000-ohm single pole receiver.

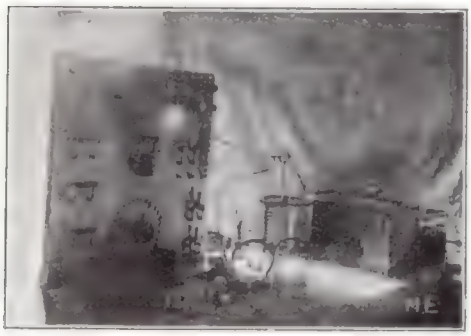
Since the photograph was taken I have added a variable condenser to my receiving apparatus. Later, when I get 3000-ohm receivers, I expect to hear outside stations. At present, I converse with

CRUTTENDEN STATION

the University, which is 40 miles away, and which is the only near-by station.—*H. A. Cruttenden, North Dakota.*

THIRD PRIZE

The accompanying illustration is a photograph of my wireless station, which I would be pleased to see in the



KEARNS STATION

pages of *Modern Electrics,* which I read with great interest each month.

For sending I use a ¾ kw. transformer, variable glass plate condenser, in oil bath, helix made of No. 0 aluminum wire, magnetic key, circuit breaker in supply circuit and rheostat.

For receiving I use a two-slide Mesco tuner, Amco receiving transformer, two fixed and one variable condensers, silicon and ferron detectors, two sets of head phones, one set of 1000 ohm and one set of Mesco 500 ohm. I have my instruments all mounted on a large marble plate.—*Chas. A. Kearns, Kansas.*

HONORABLE MENTION

The accompanying illustration shows a flashlight of our double receiving station. The instruments used are 2 E. I. Co.'s tuners (one of which is not shown in picture), two of their fixed condensers and two of their Junior fixed condensers; two pairs of Brandes Superior phones, one 250-volt lighting switch;

ADAMS AND CORWIN STATION

also other switches. We each use three detectors apiece: 1 galena, 1 silicon, and 1 ferron. The detectors are of our own make. We use two 4-point switches to throw in our detectors, also one round 4-point switch to work the buzzer test. It is so arranged that either one can use the buzzer by just throwing a couple of switches.

Our aerial is composed of four antenium wires spaced two feet apart on bamboo spreaders. It is 85 feet long and 45 feet high. With this station we get very good results—we hear the government station at Arlington, Va., when they send out the correct time at 10 p. m. Also the high powered station, at Sayville, L. I., and many other stations

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The I.C.S. Can Raise Your Salary

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But these men made up their minds that they would prepare themselves for better jobs. And with the help of the I.C.S. they "made good." Today they are receiving three or four times their former salaries. Their work is a pleasure. Their opportunities for advancement are almost unlimited.

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Mark and mail the attached coupon. It won't obligate you in the least—and the I.C.S. will show you how they can raise *YOUR* salary by training you for a good job in the occupation that is most to your liking.

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Please explain, without further obligation on my part, how I can qualify for a larger salary and advancement to the position, trade, or profession before which I have marked X.

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Dynamo Foreman	Contracting and Build'g
Wireman	Architectural Draftsman
Mining Engineer	Plumbing and Heating
Telephone Expert	Chemist
Surveyor	Bookkeeper
Civil Engineer	Advertising Man
Automobile Running	Civil Service Exams.
Agriculture	Salesmanship

*Name*_____

*St. and No.*_____

*City*_____ *State*_____

*Present Occupation*_____

and boats. We read *Modern Electrics* and think it is a very good magazine for all electrical and wireless fiends.—*B. Adams and E. Corwin, New York.*

HONORABLE MENTION

I present herewith a photograph of my wireless station.

My receiving set consists of a three-slide tuning coil 1½ feet long, two condensers of small capacity, an electrolytic detector and a pair of Brandes Superior receivers.

The sending set comprises a two-inch spark-coil, two Murdock moulded condensers and a heavy wireless key.

The aerial consists of six strands of

HALE STATION

No. 12 wire 80 feet long and is about 30 feet above the ground.

I have received messages from the coast with my receiving set.—*Herbert D. Hale, Pennsylvania.*

HONORABLE MENTION

I am enclosing a photograph of my wireless apparatus.

It has been in operation only four days, but I have had remarkable results. At present I am using a 30-foot aerial, but will have a 90-foot mast complete in a few days. My aerial has six wires 125 feet long.

Sending apparatus consists of ¾ kw. transformer (not shown), ½ kw. trans-

WILSON STATION

former coil, four small coils for short distance, condenser, flanged spark gap, rotary spark gap with mechanical interrupter, a large point wireless key and a special high speed vibroplex key.

Receiving apparatus consists of receiving transformer, Blitzen R. V. condenser, five Ferron style detectors, also galena and perikon detectors. Phones are 3000 Western Electric.

With exception of condensers, loose-coupler and coils all instruments are home made and mounted on Italian marble bases.

My call is DW and I would be glad to hear from anyone in my range. At present I can send only twenty miles.—*Paul Wilson, New York.*

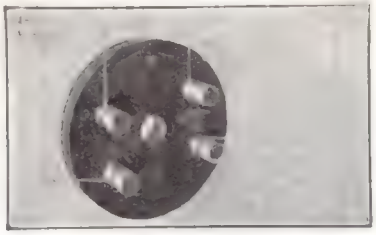
HONORABLE MENTION

For receiving I use a double-slide tuner, three detectors—galena, silicon and perikon—fixed and variable condensers and 2,000 ohm professional head set.

For sending I have a W. E. Co. one-inch coil, condenser, zinc spark gap, key and four dry cells.

When receiving I employ the galena detector more than the others, as I find I can hear the longest distances with it, having heard nearly all the Government and commercial stations between and including Boston to Key West. I have transmitted six miles with this set.

My aerial is 65 feet long, 40 feet high



Price $2.00

The Blitzen Duplex

loading coil will prove to be the most efficient "step-ladder" you can use to climb to the long wave lengths employed by the new government station at Arlington and other high power stations now beyond the reach of your set. This little device will double your pleasure and the utility of your set. It may be used in connection with any receiving transformer. The two coils wound in a slotted hard rubber disc have *coupling between them*, and are connected in both the primary and secondary circuits.

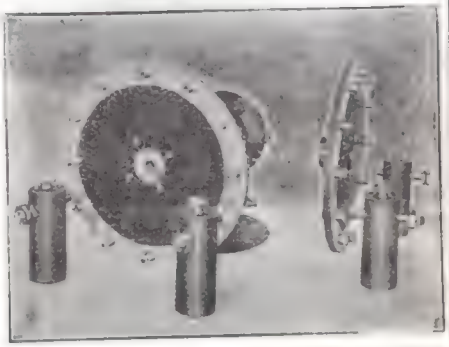
The Blitzen Rotary Spark Gap

Consists of a 5¾" hard rubber disc with 12 spark points and a cast iron hub with set screw for fastening direct on motor shaft. Two hard rubber posts carry adjustable stationary electrodes. Satisfactory up to 1 kilowatt.

Price complete without motor.....$5.50
Rotary wheel without stationary posts..... 4.00

Specify whether for ¼" 5/16" or ⅜" shaft.

Why not be up to date and send 4c stamps for complete catalog of apparatus a little better than the best.



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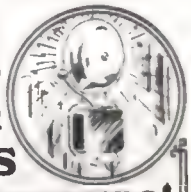

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at one end and 20 feet at the other. It consists of four wires spaced four feet apart.

I am a licensed radio operator, ama-

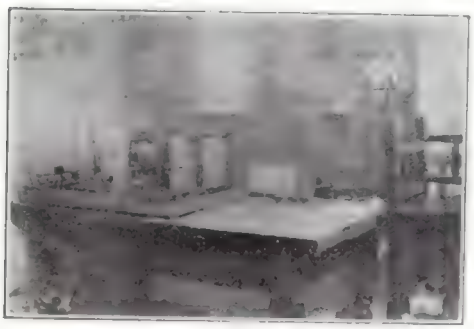
HARTLEY STATION

teur first grade.—*M. E. Hartley, District of Columbia.*

HONORABLE MENTION

In the accompanying view may be seen my wireless outfit. The receiving set consists of an Electro loose-coupler, fixed and variable condensers, two silicon detectors and a pair of Mesco 1,500 ohm head telephones.

For sending I employ a two-inch coil operated on two six-volt 60 ampere-hour storage batteries, a helix compris-



PENFOLD STATION

ing eight turns of aluminum wire, zinc spark gap and key.

My aerial is 70 feet long and about 125 feet above the ground, consisting of four strands of aluminum wire spaced two feet apart. I have obtained very good results from this outfit and I am in constant communication with a friend living about five miles away.—*C. R. Penfold, New York.*

ELIMINATING INTERFERENCE

(*Continued from page* 883)

But both of the above methods are somewhat crude, and they are not so convenient as it is possible to have it. The third method is to connect a protective condenser to power circuit, as required by the Underwriters. This eliminates the humming, as well as all extra switches, etc.

Now. I can't say that the above methods will prove out in cases where the aerial is parallel with high tension wires. but I know that they work in my case.

In connection with the foregoing, I wish to add that when I connect a protective condenser to the 110 volt circuit, the high potential surges are *increased* instead of being decreased, as they should be. I at first used the protective condenser sold by the Clapp-Eastham Company, and when I would send, fuses in other parts of house would be blown, lamps burned out, and lamps would also be occasionally dimmed, at intervals, more than usual, due to drop in voltage. I wrote to the Company, and they said this could only be due to certain conditions, as to capacity, etc., and they hardly thought this possible. They suggested that the condenser might be broken down, but I have since tried other condensers with the same disastrous effect.

Ordinarily, if I take a screw driver having a wooden handle, and bring the metal part near to metallic conductor of the 110 volt circuit, I can draw a spark barely 1/32-inch long. This high potential does not seem to do any harm, but when I use a "kick-back" condenser, things do get hot, as I found out in the operation of a motor for my rotary gap. This motor was made by Joseph Weidenhoff, of Chicago, Ill., and while the insulation is sufficient, ordinarily, it proved to be too light when a condenser was used, and the field coils were badly burned out on three different occasions. This sounds peculiar, but is true, nevertheless, and I would surely be up against it, if the Underwriters were to demand that I use the protective condensers.—*H. N. Umbarger.*

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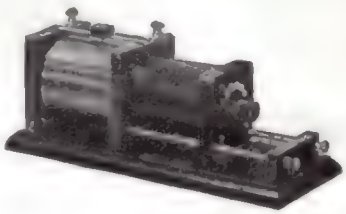
Correctly designed and honestly built for a definite duty, for present satisfaction and future service, either instrument will fill the requirements of the most exacting.



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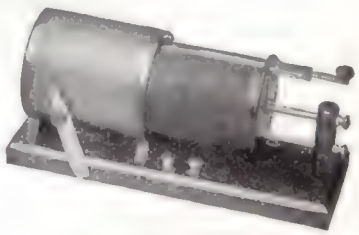

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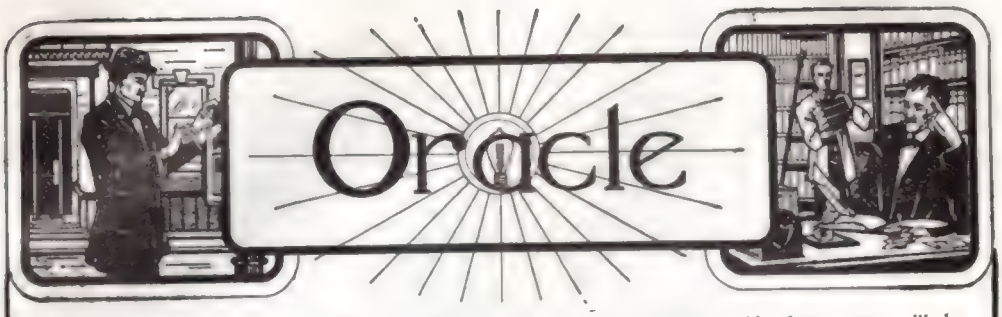


Queries and questions pertaining to the electrical arts, addressed to this department, will be published free of charge. Only answers to inquiries of general interest will be published here for the benefit of all readers.

On account of the large amount of inquiries received, it may not be possible to print all the answers in any one issue, as each has to take its turn. Correspondents should bear this in mind when writing.

Common questions will be answered by mail if 10 cents to cover expenses have been enclosed for each question. This class of correspondence has grown to such proportions that we can no longer answer questions by mail free of charge.

Owing to the additional labor required in the gradual advance of the date of publication of this magazine, there will be more or less delay necessary in answering questions and we therefore cannot undertake to furnish quick replies, for the next few months at least.

Special information requiring a large amount of calculation and labor cannot be furnished without remuneration. THE ORACLE has no fixed rate for such work, but will inform the correspondent promptly as to the charges involved.

NAME AND ADDRESS MUST ALWAYS BE GIVEN IN ALL LETTERS. WHEN WRITING ONLY ONE SIDE OF QUESTION SHEET MUST BE USED; DIAGRAMS AND DRAWINGS MUST INVARIABLY BE ON A SEPARATE SHEET. NOT MORE THAN THREE QUESTIONS MUST BE ASKED, NOR SHALL THE ORACLE ANSWER MORE THAN THIS NUMBER. NO ATTENTION PAID TO LETTERS NOT OBSERVING ABOVE RULES.

WE CANNOT ANSWER QUESTIONS REGARDING SENDING AND RECEIVING RANGES.

A CORRECTION

I notice in the June *Modern Electrics* in answer to inquiry number 2404 you say that there is an electrical show held in Chicago every year, usually in the early autumn season. It might be of interest to your readers to know that the last annual electrical show was held during January, 1911, and since that time there has been no electrical exhibition in this city. Thanking you for the space. —*Charles M. Walker, Jr.*

INDUCTION FROM POWER LINES

(2405) Wm. A. Sisson, Ohio, states:

Q. 1.—Having swung his aerial at right angles to the power lines, he is still unable to get rid of the induction. He hears a bubbling sound in the receivers from 5 p. m. onward.

A. 1.—Several amateurs in New York have been bothered in the same way and we have come to the conclusion that there must be a high frequency surge on the arc light lines in the vicinity. We do not know of any remedy for this. The noise will probably stop in a few days.

CALL LETTERS

(2406) D. A. P., L. I., asks:

Q. 1.—What are the call letters of Arlington, Va. and Mare Island, *Mass.?* And who is FWS?

A. 1.—Arlington—NAA; if you refer to the station at Mare Island, *Cal.*, the call is NPH. FWS is the station at Watch Hill, Conn., owned by the National Electric Signaling Co.

Q. 2.—What instruments would be needed to hear the Telefunken station at Sayville, L. I.?

A. 2.—This station (call letters WSL) uses two waves; one of about 600 meters for short distance, and one of about 2,800 meters for long distance and press work. A tuning coil, detector, receivers, and a fixed condenser are necessary to hear the low wave. For the long wave, you will need an extra large tuning coil or two smaller ones in series.

HOOK-UP

(2407) Merritt Hosmer, California, requests:

Hook-up for single slide tuner, silicon detector, and 1,000 ohm 'phones.

Take Your Choice

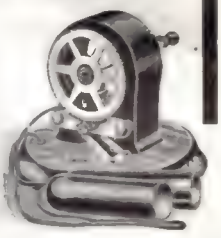
With a Trial Subscription to Modern Electrics
"The Electrical Magazine for Everybody"

Little Hustler Motor

This well-known motor is 3½ inches high, finished in black enamel with nickel-plated trimmings. Has a three-pole armature, causing the motor to start without assistance when the current is applied. It is fitted with a pulley for running mechanical toys, models, etc.

Price $1.00 postpaid, or given free with one yearly subscription to MODERN ELECTRICS. **$1.50**

"Tesla" Magneto



Operated by crank; wheel and pinion, cut teeth, insuring smooth action. Substantial brass bearings. Well made throughout. Finished in red enamel, nickel trimmings. Polished wood base, with neat bushings for flexible conducting cords. New and neat design—the best in this class.

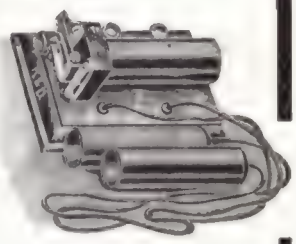
Price $1.00 postpaid, or given free with one yearly subscription to MODERN ELECTRICS. **$1.50**

Bleriot Monoplane

Guaranteed to fly or money refunded. This model has never been sold by dealers for less than $2.00, but for a limited time only we will send it prepaid absolutely free with a trial subscription.

Price $1.00 postpaid, or given free with one yearly subscription to MODERN ELECTRICS. **$1.50**

Medical Coil



This apparatus works efficiently on one cell, dry or other battery. The coil has perfect regulation; the current at the handles varying from imperceptible to all that can be borne. The coil and vibrator parts are very compactly built; the vibrator contacts are pure silver—thought by many superior to platinum. Mounted on a polished wood base, with neat bushings for the passage of the conducting cords. Coil ends are finished in polished black enamel. All metal parts nickel plated. Well made throughout.

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Modern Electrics Magazine MODERN ELECTRICS **231 Fulton Street New York N. Y.**

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For your battery troubles is an

Amco Storage Cell

Dry cells or primary batteries must be thrown away when exhausted AMCO STORAGE CELLS can be recharged repeatedly.

OUR CATALOG explains this and tells all about the different sizes. It also lists over 500 electrical articles. WIRELESS APPARATUS, motors dynamos, etc.

A call list of 1600 wireless stations free with each catalog. Send 4c. in stamps. Write now. No postals answered.

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"The Experimenters' Supply House."
Box 720. Upper Montclair, N. J.

FIFTEEN DOLLARS

Brings you our new

AUDION DETECTOR SET

the detector with the trouble left out. You need it in your station, and a trial will convince you.

Superior to other detectors in use today and will increase your range 50 to 100%. All valves tested and guaranteed.

Let us send you our illustrated leaflet; a stamp will bring it.

The Wireless Mfg. Co.
CANTON, OHIO

If You Seek to Increase Your Income

If you would welcome an opportunity to turn spare moments into DOLLARS

Turn to Page 432

There you will find an offer which points the way to MORE SPENDING MONEY

NOW — TODAY!

HOT WIRE METERS

FOR MEASURING HIGH FREQUENCY CURRENTS

Our automatic compensator (patent applied for) protects against atmospheric and external temperature changes.

Standard range, 0 to 700 milliamperes. Other calibrations built to order.

Victor Electric Company
JACKSON BLVD. AND ROBEY STREET, CHICAGO

When writing, please mention "Modern Electrics."

A. 1.—See November, 1912 number, query 2196.

Q. 2.—With above instruments and 73 meter aerial, can I hear the new station being erected at South San Francisco for trans-Pacific work?

A. 2.—We doubt very much if you could hear this station with the aerial you mention. You would need a very much longer one.

BURGLAR ALARM

(2408) C. E. Hendrey, Illinois, asks:

Q. 1.—How to rewind an 8-volt voltmeter to work on 110 volts.

A. 1.—It is not necessary to rewind it. Wind up some resistance coils of about No. 36 or No. 38 wire and connect them in series with the meter and determine by experiment when the meter reads correctly. It is then necessary to have it calibrated by comparison with a standard voltmeter.

Q. 2.—What resistance to wind a double-balanced relay to be able to use dry batteries on a closed circuit system?

A. 2.—The relay should be wound to at least 1,500 or 2,000 ohms resistance. We do not, however, advise the change.

MERCURY RECTIFIER

(2409) D. A. Munger, Ohio, writes:

Q. 1.—Have constructed mercury arc rectifier as described by Mr. Horton in the Jan. issue. I fail to get an arc between the iron and the mercury. What is the trouble?

A. 1.—It is necessary to start the arc. This may be done either by tipping the lamp until the mercury reaches the iron and then setting it back again, or by passing a spark from a small induction coil through the tube.

Q. 2.—Can the speed of an induction motor be decreased while starting without decreasing the torque?

A. 2.—No. Any attempt to slow down the motor results in a decrease of the torque. There is a method depending upon cutting resistance into the rotor winding, but this necessitates rewinding unless the motor was built with a speed regulator.

WAVE LENGTH

(2410) H. E. Blaisier, Jr., Iowa, asks:

Q. 1.—What is the wave length of the

Marconi Wireless Telegraph Company of America

There are 30 vacancies in the Wireless Technical Class convening June 10th to 15th. In replying state qualifications, age, etc.

Instruction given in Continental code—Traffic—Commercial Routine—Technical Construction, Etc.

Only those who can receive in Continental code at a speed of 10 or more words per minute, or who have been first-class commercial operators need apply.

Applicants can secure a personal interview between 9 and 10 a. m., Monday to Friday. Address communications to

School of Instruction. **INSTRUCTING ENGINEER**
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Spanish for Operators
New class in Engineering starts June 30

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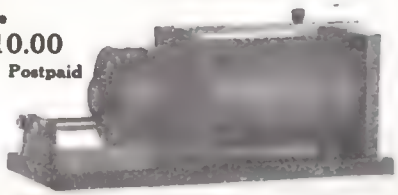
LOOSE COUPLER

Price $10.00 Postpaid

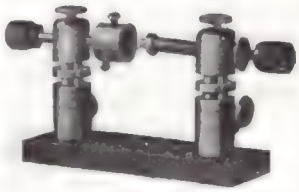


The PEER of them all. It is the most serviceable and scientifically constructed instrument on the market. The SECONDARY rides upon two heavy rods to which the taps are permanently secured, thus insuring absolute contact.

It is fitted with a switch that is indeed a SWITCH, that makes positive perfect contact in every position but also is very flexible in adjustment.

THE SPECIALTY ENGINEERING COMPANY,
217 S. Central Ave., Baltimore, Md.

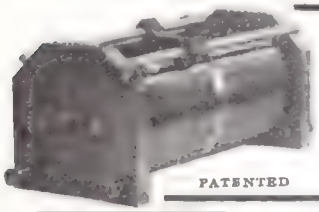
A New "M-F" Product



A Detector that *really is* the acme of sensitiveness and one that allows *all portions* of the crystal to be reached. Some of the details of construction are — swivel posts, three screw cup to grasp the crystal firmly, highly sensitive spring contact, all metal parts nickel plated, hard rubber trimmings. The price is only **$3.00.**

Better send for one today. It will increase your range wonderfully.

THE MERKER-FLOCKER ELECTRIC CO.
957 LIBERTY AVE., PITTSBURGH, PA.



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NEW RECEIVING TRANSFORMER ONLY $10.00

This new and novel instrument not only embraces the features of simplicity, efficiency and durability, but it brings in good loud clear signals and cuts out unwanted stations in a most satisfactory way. If this transformer does not do all that we claim for it you may return it within ten days and your money will be refunded. **Write for Circular.**

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Columbia Batteries

Give Strong Current For Wireless Work

THEY LAST LONGER

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For Horn and Starting Work Has No Equal

In Service Maximum
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Local Action Quickest
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What Have You Invented?

Your invention may be worth *thousands of dollars*—if it is commercially developed.

Our Specialty is developing inventions of all kinds—electrical as well as mechanical. We secure capital for exploiting patents of merit. We build instruments and apparatus to order, according to your own design with greatest accuracy. We make parts of brass, aluminum, iron, steel, hard rubber fibre, etc., of all description and in any quantity. Tools, punches, dies, drills, jigs, gauges and special machinery. Drawings under the best mechanical advice.

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Here is something entirely new in Razor Hones. It is a mechanical device developed in our shop, and users say, "It's worth its weight in gold."

Let us send you one of these remarkable hones postpaid for $1.00, or if you do not need a hone for your own use, you can make a handsome profit representing us in your territory.

Write to-day for agent proposition.

MULLER & JABLONSKY, Bleecker and Bank Sts. NEW YORK, N. Y.

8 INCH FAN 110 volts A.C. or D.C. **8.50** *Delivered*

Best finish in black enamel and nickel plate on brass.

ALWAYS SATISFACTORY
MONEY BACK IF WANTED

75-cent silk cord and plug included if dealer's name is given.

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Battery Fans Not Toys—Any Voltage Same Price

Build and Maintain Your Own
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PRICE 50 CENTS

GUARANTEED ELECTRIC STORAGE BATTERY CO., St. Louis, Mo.

Rebuilt Typewriters at Wonderful Savings

All makes, all prices, all bargains. Have reorganized and must cash in immense stock. Will give $5.00 worth of supplies free. Write for special list D. Phone 5678 Barclay.

Consolidated Typewriter Exchange, Inc.
(Established 1881) 245 Broadway, New York

When writing, please mention "Modern Electrics."

following aerial: 6 wires 120 feet long, 30-foot lead in and 15-foot ground wire?

A. 1.—About 220 meters.

Q. 2.—Which code is in general use, Continental or Morse?

A. 2.—The Continental code is used more in wireless.

Q. 3.—Which transformer is the best, Thordarson or Blitzen?

A. 3.—As stated before in these columns we cannot answer questions on the relative merits of different makes of instruments.

LIGHTNING GROUND

(2411) Wm. H. Matern, N. Y., writes:

Q. 1.—My lightning ground consists of a large boiler sunk into the ground and about 150 feet of stranded galvanized iron stretched out fan-shape from the boiler. These wires are soldered to the boiler and a No. 4 copper wire runs to my lightning switch from the boiler. Does this comply with the Underwriters' Rules?

A. 1.—Your ground is excellent if the earth near the boiler and radiating wires is damp. If your lightning switch is rated at 100 amperes or more, the ground complies with the rules.

Q. 2.—I have four No. 14 aluminum wires from my aerial to the lightning switch. Is it necessary to substitute a No. 4 copper wire?

A. 2.—It is not required but it would be a very good thing to do.

Q. 3.—What is the theory of the lightning arrester? Would one be just as good as a lightning ground?

A. 3.—The usual form of lightning arrester is a minute gap placed between the wire to be protected and the ground. This is useless for wireless as the high voltage used in transmitting would jump the gap and go to the ground.

LICENSE AGAIN

(2412) Wm. A. Owen, N. Y., asks:

Q. 1.—The difference between a transformer-coil and a transformer.

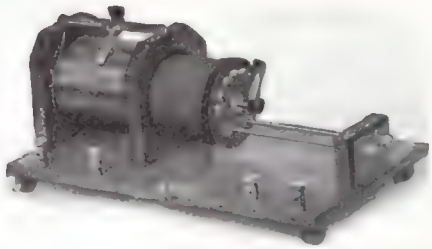
A. 1.—A transformer-coil is an open-core transformer.

Q. 2.—Which is best, aluminum or phosphor-bronze aerial wire?

A. 2.—Phosphor-bronze is the better.

YOUR OPPORTUNITY

$7.50 Loose Coupler **Special Price, $1.93**



We have received so many requests for parts for our well-known loose coupler, we have decided to offer during the month of *July only,* a complete set of parts ready for assembling at a cost which you would pay for the raw material alone if purchased anywhere else. All wood parts are of heavy oak handsomely finished. We furnish enameled wire for primary winding, silk covered for secondary.

This coupler when assembled sells by most houses at $7.50 to $8.00 and is a beautiful and efficient instrument. This is your opportunity to save nearly $6.00 and secure an up-to-date well-made instrument.

Order your loose coupler to-day.

All the parts packed weigh about 3 lbs., if you desire sent by parcels post add from 11c. to 36c., according to the zone you live in. Act now before it's too late.

We have the following coils taken in lieu of a debt which we offer you while they last:

Eighteen—	1½	inch	wireless	coils	at $4.38,	sold	regularly at	$ 7.50.
Seven	—2	"	"	"	at 6.42,	"	" "	10.00.
Four	—3	"	"	"	at 13.15,	"	" "	18.00.

(Sent by express collect.)

You will never get another opportunity like this again. If you need a coil send for it at once.

SPECIAL ORDER BLANK

HUNT & McCREE, *Date*.....

92-94 *Murray St., New York.*

Gentlemen:—Enclosed find money order / cash / check *for*.....*for which kindly send me the following as per special offer in July Modern Electrics.*

Name.....

R. F. D. *Address* .....

Needed In Every Home

The "Dandy" Vacuum Cleaner

for

Carpets, Rugs, Walls, Tapestry, Curtains, Drapery, Pictures, Etc.

For Sweeping and Cleaning

The introduction of this Apparatus has created a revolution against the broom.

It is a well known fact that a broom presses most of the dirt into the carpets and only partly sweeps the surface while it raises the germs and dust in the room.

The suction of our cleaner draws **All the Dirt and Germs into** the receptacle of the cleaner and remains there until same is emptied.

The durable construction of our cleaner makes the apparatus last a lifetime. The weight of the apparatus being about 10 lbs. only, enables a child to handle and operate same very easily.

With the "Dandy" cleaning day will be converted into a day of pleasure.

We are starting the sale of these apparatus at the special price of $6.65, delivered prepaid anywhere in the U. S.—A price every household can afford. **Send us your order to-day.**

You will never regret it.

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Every sick man and woman in the land should read this great booklet. Costs nothing to get it. It points the way to honest health, true wealth, real happiness. The more you have suffered, the severer your ailment, the more you have "doctored"—the more you need to read this wonderful story about Oxygenator, the most marvelous discovery of the age. No matter what the age, it is to your advantage to read this booklet from cover to cover—whether you have stomach or bowel trouble, rheumatism, liver, kidney or bladder disorder, catarrh, lung or bronchial trouble, blood or nervous disease, ailment or weakness peculiar to men or women, scrofula, Bright's disease, blood poison, appendicitis, or what. It shows how thousands have been cured by this wonderful discovery without medicine or knife, and after all else failed.

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I WILL MAKE YOU PROSPEROUS

If you are honest and ambitious write me today. No matter where you live or what your occupation, I will teach you the Real Estate business by mail; appoint you Special Representative of my Company in your town; start you in a profitable business of your own, and help you make big money at once. Can arrange for spare time only if desired. Unusual opportunity for men without capital to become independent for life. Valuable Book and full particulars Free. Write to-day.

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When writing, please mention "Modern Electrics."

Q. 3.—Do I need a license for a ¼ or ½ kw. tuned set?

A. 3.—See answer to this question in the March, 1913, issue, query No. 2342.

AERIALS

(2413) E. W. Eppley, Ohio, inquires:

Q. 1.—Which is the better for receiving: a vertical aerial 75 feet high or a 75-foot horizontal aerial, 100 feet long?

A. 1.—The vertical one is the better for receiving.

Q. 2.—For sending?

A. 2.—The horizontal one is the better one for sending.

Q. 3.—Will both of these aerials do for receiving 1,000 miles?

A. 3.—Yes, with the proper instruments.

WAVE LENGTH

(2414) A. D. Logeman, Missouri, writes:

Q. 1.—What is the wave length of the aerial shown?

A. 1.—The natural wave length is about 275 meters. Using an oscillation transformer you could not get below 300 meters. You must use a series condenser with this aerial.

Q. 2.—What is the wave length of my receiving set?

A. 2.—Minimum about 350 meters, maximum about 3,500 meters.

Q. 3.—How far can I receive with my outfit?

A. 3.—See notice at head of this Department.

OPEN CORE TRANSFORMERS AND SPARK GAPS

(2415) C. L. Bishop, New York, asks:

Q. 1.—Is enameled wire all right for the winding of an open core transformer?

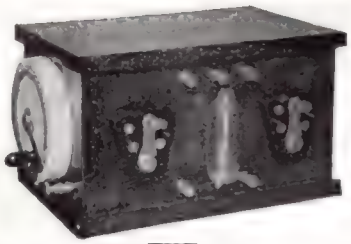
A. 1.—Yes.

Q. 2.—Is No. 16 and No. 30 wire for the primary and secondary respectively all right for a transformer?

A. 2.—Yes.

Q. 3.—Is a gas pipe with the ground wire connected with the street side of the meter a good ground?

HERE IS YOUR CHANCE



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Wallace Valve Detector

as a

Special Summer Bargain

From now until August 1st, 1913, we will sell our famous VALVE DETECTOR for TWELVE DOLLARS. With 4 x 40 storage battery the price will be $17.00.

ORDER NOW and get one of these detectors at our WHOLESALE PRICE.

Descriptive folder of this and other apparatus for a 2 cent stamp. (No postals.)

WALLACE & CO.
59 Fifth Avenue New York

BRANDES WIRELESS RECEIVERS

During the summer, atmospheric conditions make long distance reading difficult. On this account, a very sensitive and high-pitched receiver is necessary. In testing our instruments we pay particular attention to the pitch which must be of a certain tone, and alike in both receivers.

Our $5.00 Set

Improved Navy, - - - - -	$13.00
Transatlantic, - - - - -	9.00
Superior, - - - - - -	5.00
Single Superior, - - - -	1.60

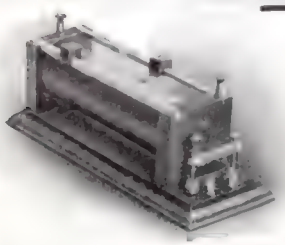
HOT WIRE METERS for both Spark Coils and Transformers, 5.50

Send Stamp for Descriptive Matter

C. BRANDES, Inc.
111-113 Broadway, New York

AGENTS

San Francisco—Ford King, 610 Balboa Bldg.
Chicago—Winger Elec. & Mfg. Co., 711 So. Dearborn Street.
Australia—G. C. Hamilton, Ltd., 177 Elizabeth St., Sydney, N. S. W.



PORTABLE RECEIVING SET

This small receiving set consists of double slide Tuning Coil, our Special Pick Detector Stand, and Fixed Condenser in the Base.

The Tuning Coil has 8½" winding space, is 2½" diam. and has genuine mahogany ends. The whole mounted on a mahogany base 4½"x12", fitted with nickelplated binding posts and all wired ready to connect the receivers to. On an average sized Aerial will respond to 2,000 meter wave length. Price, $5.00. 5c. in stamps for 1913 Catalogue. None sent otherwise.

F. B. CHAMBERS & CO.,
217 N. Ninth St., Philadelphia, Pa.

SPECIAL THIS MONTH ONLY

6-16 c. p. Carbon Lamps	.12c.
24-c. p. Carbon Lamps	.15c.
Key Sockets	.12c.
Rosettes	.10c.
Split Knobs	.01c.
3 inch Pore. Tubes	.01c.
Snap Switches	.23c.

Everything Electrical

GLENN SABIN & CO., Amherst, Mass.

DON'T EMPLOY MAKESHIFTS

We want every experimenter in Electricity and Mechanics to send for our small parts lists numbers 1 and 2. We have parts for transformers, coils, couplers, spark gaps, detectors; also rough stock, books, and anything experimental. We make anything for you at reasonable prices. Send stamps for lists.

WOODSIDE ELECTRICAL SHOPS, Metuchen, N. J.

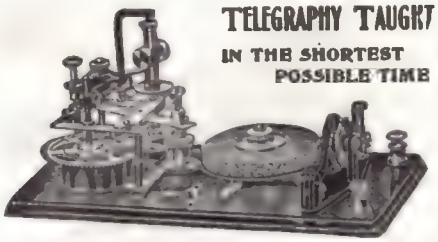
Boston Variable Condenser

25 Plates, $2.75

Boston Agent for . .
Electro Importing Co.
Same Prices.

If goods are to be sent by Parcel Post, send stamps.
Catalogue 2 cents in stamps.

M. MUELLER
18 Devonshire
22 Exchange St.
BOSTON



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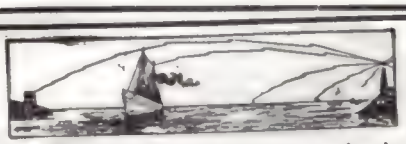
IN THE SHORTEST POSSIBLE TIME

The Omnigraph Automatic Transmitter combined with standard key and sounder. Sends your telegraph messages at any speed just as an expert operator would. Five styles $3 up. Circular free.

Omnigraph Mfg. Co., 39½ Cortlandt St., New York



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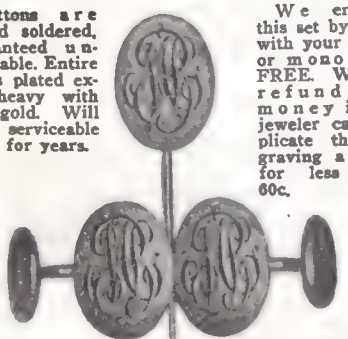

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A. 3.—Yes, if the ground wire is No. 4 copper or equivalent size.

FORMULA FOR WAVE LENGTH

(2416) Ray Harrison, Nebraska, would like:

Q. 1.—Formula for finding the wave length of an aerial, loose coupler and tuning coil.

A. 1.—There is no reliable way to measure the wave length of a receiving set except with wavemeter. The formula for wave length is as follows: $59.6\sqrt{CL}$ where C is the capacity in micro-farads and L the inductance in centimeters. It is practically impossible to measure the capacity of the tuning coil and loose coupler though.

WAVE LENGTH

(2417) Harry C. Schwering, Pa., asks:

Q. 1.—What is the maximum wave length to which I can tune with an aerial of 100 meters wave length and a single slide tuner wound with ½ pound No. 22 enameled wire?

A. 1.—About 1,000 meters.

Q. 2.—Could I get higher by using a loose-coupler wound with ¼ pound of wire on the primary and No. 34 on the secondary?

A. 2.—No. The tuning coil is the better as regards high wave lengths.

WAVE LENGTH

(2418) Arliss Winn, Tex., writes:

Q. 1.—What is the lowest and highest wave length I can get with the instruments shown in the enclosed drawing?

A. 1.—Minimum about 150 meters, maximum about 3,000 meters.

Q. 2.—Should I be able to get the station at Arlington with this set?

A. 2.—You can reach his low wave (2500 meters) but we cannot say whether your set is sensitive enough to hear him.

WAVE LENGTH AGAIN

(2419) John Sharp, Massachusetts, inquires:

Q. 1.—Wave length of aerial, total length of aerial and leads being 200 feet.

A. 1.—About 265 meters.

Q. 2.—What is the longest aerial I can use and still be below 200 meters?

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A. 2.—The natural wave length of an aerial is approximately four times the length of the aerial, lead-in and ground combined. Allowing 50 meters for the wave of the inductance of oscillation transformer, we see that the total length must not exceed 115 feet.

INDUCTION

(2420) Carl Howard, Ohio, asks:

Q. 1.—Will some telephone wires 10 feet from my aerial have any effect upon it?

A. 1.—No. There is very little induction from the telephone wires.

RECEIVING RANGE AGAIN

(2421) Samuel Malbin, New York, requests:

Q. 1.—The range of his receiving set.

A. 1.—We must refer you to the head of these columns, where you will see that all questions as to range of sets are prohibited.

LOOSE COUPLERS AND TRANSFORMERS

(2422) Harold Gray, Massachusetts, inquires:

Q. 1.—Can two loose couplers be used to advantage in receiving?

A. 1.—Yes. See the article by P. Mertz in the June, 1913, issue.

Q. 2.—How would the following coil be rated in KW?—Coie, 1 inch thick and 11 inches long. Primary, 1½ pounds No. 14. Secondary, 3 pounds, No. 36.

A. 2.—The coil would consume about ¼ kw. on 110 volt, 60 cycles.

WAVE LENGTH AGAIN

(2423) F. Bisbee, New Hampshire, asks:

Q. 1.—How long can an aerial be to comply with the law?

A. 1.—See answer to query No. 2419 in this issue.

Q. 2.—Give dimensions for a loose coupler to tune to 1,500 meters in connection with this aerial.

A. 2.—See article by H. Danner in the December, 1912, issue.

OSCILLATION TRANSFORMER

(2424) Henry Paulson, New York, writes:

Q. 1.—Please give list of material and

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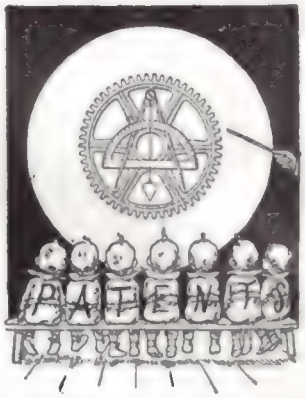

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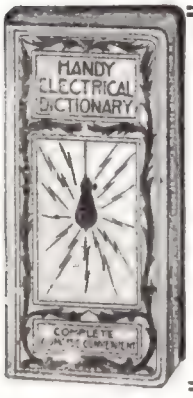

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dimensions of an oscillation transformer.

A. 1.—See supplement to the June, 1912, issue.

AUXILIARY LOOSE COUPLER

(2425) Harold Hursh, Oregon, inquires:

Q. 1.—The best size to wind the loose coupler described in the March, 1913, issue?

A. 1.—The author recommends No. 28 on both coils, but if you make the coils a little larger and use No. 24 or No. 26, the resistance will be less.

Q. 2.—What did you mean when you said the loose couplers should be connected in series?

A. 1.—Just what we said. The two secondaries are connected in series and the two primaries also conected in series. If you do not hear well with this arrangement, reverse the connections of one of the secondaries, *i. e.*, reverse the two wires on the auxiliary secondary.

WIRELESS SET

(2426) Edward Burns, New York, asks:

Q. 1.—The instruments necessary to a complete wireless set?

A. 1.—A tuning coil or loose coupler, detector, fixed condenser, and a telephone receiver are necessary. Other instruments such as a variable condenser and a set of head receivers are desirable.

SPARK GAP

(2427) Ernest Lang, N. J., writes:

Q. 1.—Will the spark gap described by P. Mertz in the February, 1913, issue comply with the wireless law?

A. 1.—No, not unless the gap is kept well cooled and all connections made with heavy cable and as short as possible.

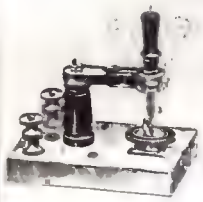
CONDENSER AND MAGNETIC LEAKAGE TRANSFORMER

(2428) Oliver Cook, Massachusetts, inquires:

Q. 1.—The capacity of the condenser used in the central energy Bell telephones. Also how to make one.

A. 1.—Capacity is 2 micro-farads. We would advise you to purchase one from

HEADQUARTERS



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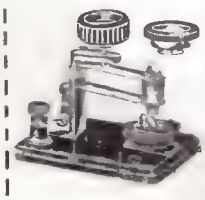

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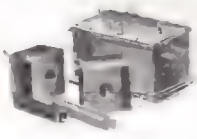

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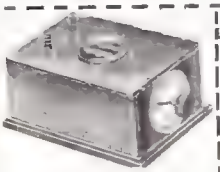

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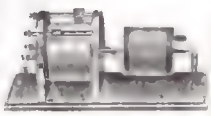

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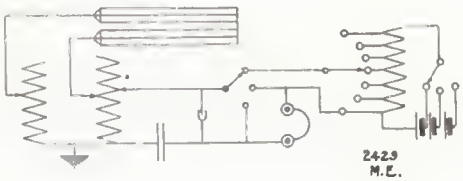
HOOK UP

(2429) G. L. Wilson, Clayton, N. J., asks:

Q. 1.—Hook-up of the United Wireless Type D tuner?

A. 1.—Diagram below.



WIRELESS LAW AGAIN

(2430) W. R. Slieman, Pennsylvania, inquires:

Q. 1.—Can I use a Thordarson H1 transformer, rotary gap and oscillation transformer and comply with the law?

A. 1.—Yes, provided that your wave length does not exceed 200 meters.

AERIAL

(2431) Wm. H. Earl, Iowa, writes:

Q. 1.—Have 640 feet of wire for an aerial for receiving only. What is the best type?

A. 1.—Use two strands as long as possible and connect them together at the far end and bring a lead from each wire to the instruments. Use loop aerial connection on your set.

Q. 2.—Would it be any safer to ground the aerial at both ends with 35 ampere switches.

A. 2.—It would be better but it is not necessary. Better ground one end with a 100-ampere switch.

Q. 3.—Is it necessary to ground the guy wires of a pole 25 feet high?

A. 3.—No.

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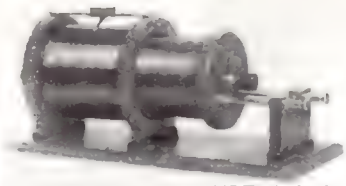

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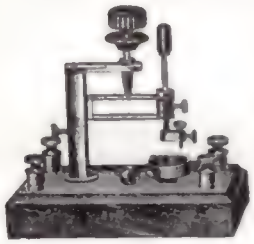

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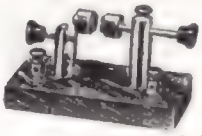

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TRANSFORMER

(2432) A. H. Whitehouse, Canada, wishes:

Q. 1.—Data for a transformer to change 110 volts to 52 volts.

A. 1.—See article by Mr. Horton in the February, 1913, issue.

MAGNETO

(2433) Cecil Hebb, Nova Scotia, writes:

Q. 1.—Have an old telephone magneto and would like to use it to charge a storage battery. How shall I rewind it?

A. 1.—A magneto gives alternating current which cannot be used to charge storage batteries.

Q. 2.—Give a detailed description of the "Mercury Arc" as mentioned in the August, 1912, issue.

A. 2.—We have no detailed description of this light.

FORBIDDEN QUESTIONS

(2434) Charles Melton, Missouri, asks:

Q. 1.—His sending range with 320 foot aerial and ½-kw. transformer.

A. 1.—Your wave length with this aerial is more than 200 meters and therefore you are not complying with the law. Also see the head of these columns.

Q. 2.—What is my wave length?

A. 2.—See answer to query number 2419.

Q. 3.—What is my receiving range?

A. 3.—See answer to Q. 1.

WAVE LENGTH AND ANCHOR GAP

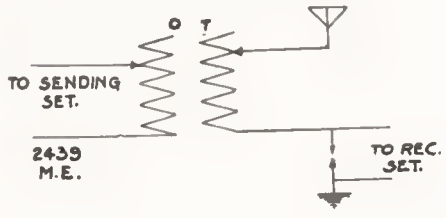
(2435) Charles Jolly, Idaho, inquires:

Q. 1.—The wave length of his aerial.

A. 1.—See answer to query number 2419.

Q. 2.—Give connections of the anchor gap as used for a switch to change from sending to receiving.

A. 2.—Connections given below.



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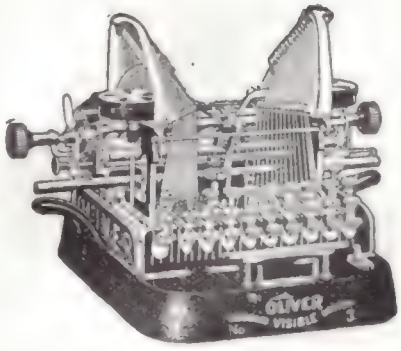

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RECTIFIERS

(2436) R. M. Willman, Texas, asks:

Q. 1.—Name three methods by which A. C. may be changed to D. C.

A. 1.—The electrolytic rectifier, consisting of an aluminum and a lead plate in a solution of sodium phosphate, the mercury arc rectifier which was described in detail in the January, 1913, issue, and the rotary converter or motor-generator which consists either of an A. C. motor coupled to a D. C. generator, or two windings, one A. C. and one D. C., on the same machine.

Q. 2.—Will an electrolytic rectifier give a steady direct-current without evidence of cycles?

A. 2.—No. This rectifier gives a pulsating direct current.

Q. 3.—What size wire should be used in making a one-inch coil and how much of it?

A. 3.—Primary ¾ pound, No. 16, secondary, 1 pound, No. 36 wire.

WAVE LENGTH AND INDUCTION

(2437) Philip Wachtell, Indiana, inquires:

Q. 1.—The wave length of his aerial.

A. 1.—See answer to query No. 2419.

Q. 2.—Can my lead-in be taken 20 feet from one end?

A. 2.—No. The lead must be taken either from the center or from one end.

Q. 3.—Would my aerial be affected by the electric light wires which run under it and at right angles to it?

A. 3.—As long as your aerial is at right angles to the wires, we do not believe you will have any trouble from induction.

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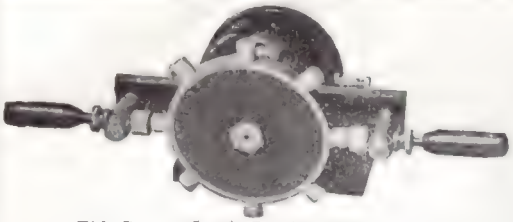

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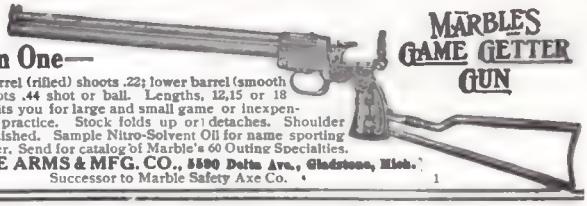

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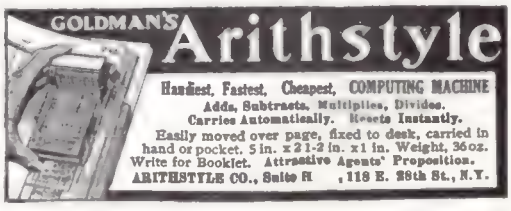
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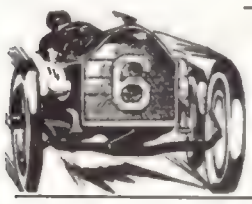

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WILL PUT WIRELESS STATION IN ARCTIC

The plans of the Arctic Expedition, which Donald B. MacMillan, Peary's former aid, is to lead for the purpose of discovering and exploring the hypothetical Arctic continent known as Crocker Land, have just been made public.

The expedition will leave New York on July 2 or 3 on the Newfoundland sealer *Diana*, sailing from the Brooklyn Navy Yard.

The scientists of the expedition will do work in geography, geology, oceanography, zoology, including ornithology, mammalogy, ichthyology, and all kinds of invertebrate ologies, but the most interesting work to the public, as well as in some respects the most important, will be experiments in wireless telegraphy, and far-reaching results are expected.

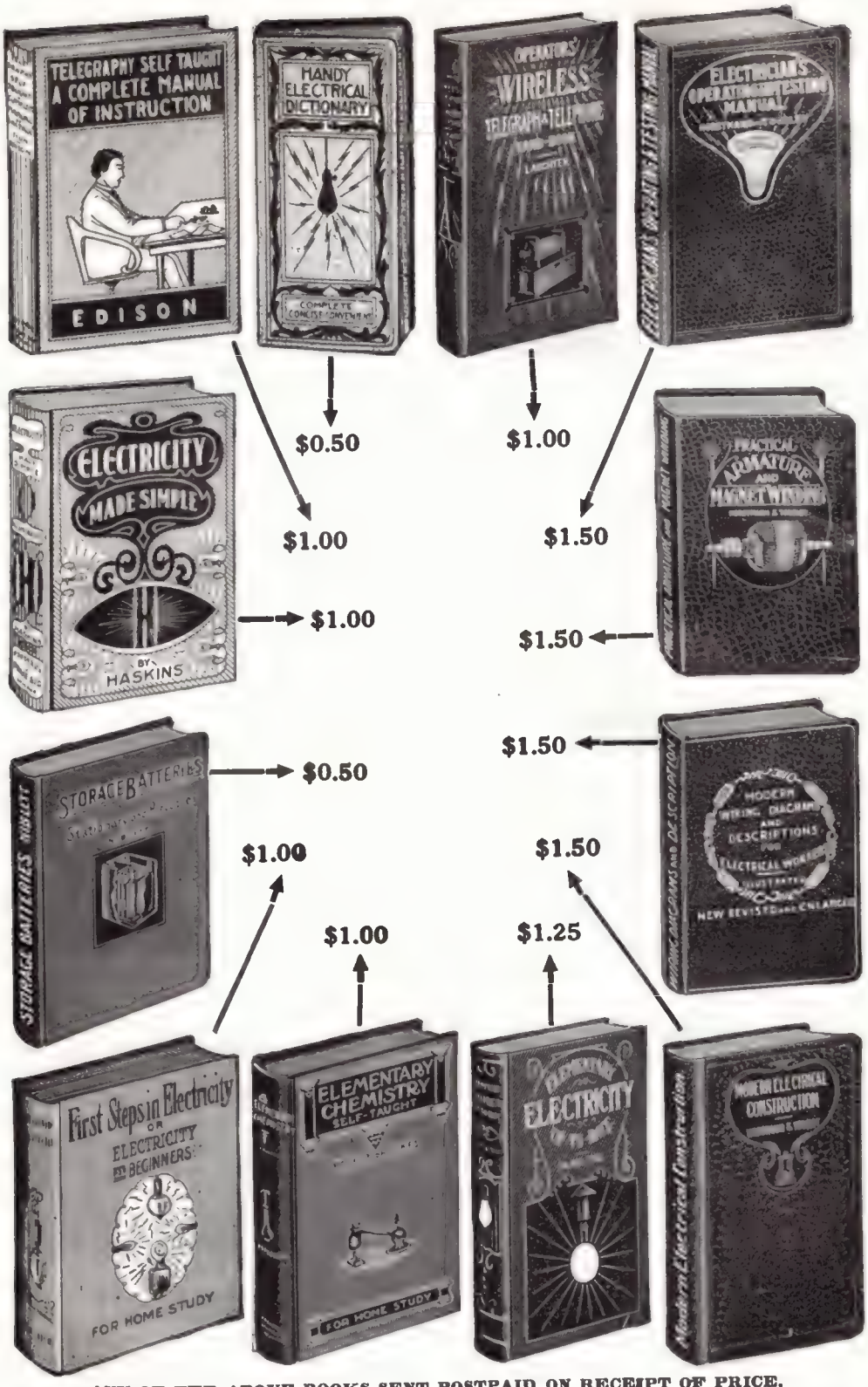
So important is this latter subject considered that the General Electric Company has furnished the expedition with all the needed electrical equipment, including powerful generators to be run by kerosene, while the Atlantic Communication Company has supplied a complete outfit of their Telefunken wireless with a range of 2,000 miles.

The expedition will make its main headquarters on the north side of Flagler Bay, where the powerful wireless station will be erected, and here, under the ideal climatic conditions of the Arctic, experiments will be conducted in order to solve the important problem of directing the Hertzian waves.

MORE WIRELESS LONG DISTANCE TESTS

According to reports to the Navy Department regarding the experiments conducted on the recent voyage of the scout cruiser *Salem* to Gibraltar to test the Arlington naval radio plant, it has been demonstrated that between the two types of radiation, the spark apparatus and the electric arc, or "undamped" oscillations, the latter is less modified by absorption as each progresses over the surface of the earth. In the experiments with the *Salem* both types of transmission were used, and up to 900 miles distance it was found that there was little if any appreciable difference in their respective energies.

It was possible in the daytime to com-



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municate with the *Salem* from Arlington with both types equally up to 2,100 miles, and at night communication with the *Salem* was easily maintained at Gibraltar. But beyond the distance of 2,000 miles it was discovered that the waves produced from the electric arc showed an increasing efficiency and possessed an energy four times as great as those from the spark apparatus.

This is attributed by the engineers of the National Electric Signaling Co., to the use of the Fessenden "Heterodyne" receiver which proved much more efficient for receiving undamped oscillations than the regular equipment provided for that purpose.

HORIZONTAL ANTENNAE

A German radio engineer named Kiebitz finds that wireless waves can be received with surprisingly good results by using an antenna made up of wires stretched along at a short distance from the ground, mounting the receiving devices at the center of the antenna. For instance, upon a large flat area near Belzig, Germany, he stretched several wires between pairs of posts at about three feet from the ground. However, a combination is made by stretching one antenna from north to south, then a second from east to west, so as to cross the first one at right angles, and in the middle. He also ran a third antenna across the middle point, and directed northeast and southwest, that is, at angles of forty-five degrees. This latter antenna was about 1,000 feet long, and lay in the direction of the Schönberg station (40 miles off) and also in the direction of the Eiffel Tower (500 miles away) and the German post of Swinemunde (140 miles). In this way he was able to pick up those two German posts, as well as the Norddeich post (250 miles distant). Signals could be heard very well from the Eiffel Tower, and Mr. Kiebitz concludes that an antenna of this length is equivalent to a vertical one of 40-foot height. Poldhu was also heard, and he could receive from Clifden and Glace Bay by using a 4,000-foot wire three feet from the ground.

It would seem, however, that experiments with antennae of this sort should of necessity be conducted in open country; otherwise but comparatively little energy would be picked up by them.

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SECTION OF OPERATING ROOM

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Third Radio District

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Correspondence

Long Distance Receiving With Small Aerials

It is generally conceded that a large aerial is absolutely necessary for the reception of long distance signals. In contradiction of this belief and for the benefit of the readers of your valuable magazine, I wish to state that this assumption is erroneous, for with an aerial of small size I am able, nightly, to hear, under favorable circumstances, all the Government coast stations as far south as NAR (Key West) and NAX (Colon, Isthmus of Panama).

My station is located in Brooklyn, and the aerial, which is of the flat top, L style, is 80 feet above the ground and 50 feet between spreaders, with a 40-foot lead-in. The intention of this letter is to point out to the readers the fact that the efficiency of amateur stations lies largely in the handling and adjustment of their receiving instruments, and that all hope of long distance work should not necessarily be dismissed because of the lack of facilities to erect aerials of large proportions.

It has often occurred to me that the average experimenter with the small aerial presupposes a certain ineffectiveness, which naturally deters him from getting out of his station all of its possibilities, and to correct this wrong impression is my chief aim. A good head

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phone and a sensitive detector are absolute necessities, and I have used with perfect satisfaction the Holtzer-Cabot phone in all my long distance work. I have experimented with all kinds of detectors, excepting the Audion, and get good results with all. Perikon, galena, silicon and iron pyrites give about equally good results, and if in proper adjustment there is little to choose between them.

With a good grade of iron pyrites, used in a Clapp-Eastham detector stand, I am able to hear NAX without difficulty. Iron pyrites is a favorite with me in local work, and used in a break in system, maintains its adjustment admirably.

My associate in these experiments, Mr. Carl Schlitz, using an aerial of even slightly smaller proportions than mine, often picks up NAR, NAU and NAW.

It should, of course, be borne in mind that sloping aerials, causing a directional effect, should be avoided.

As a reader of your magazine from its first issue, I feel a great indebtedness for the very valuable information I have received therefrom, and I trust the above may prove of interest and benefit to your readers.—*W. N. Stanley.*

EDISON STORAGE BATTERY HOUSE-LIGHTING PLANTS

The Edison Storage Battery Company, Orange, N. J., has recently issued an attractive booklet, describing the Edison Battery in use for house-lighting plants. The desirability of electric light in country homes and other places where central station service is not available, makes some sort of small, isolated plant necessary.

The book is illustrated with many views taken from a house equipped with one of the lighting sets, showing the arrangement of lights, heating devices, fans, washing machine and other electrical conveniences. Specifications are given for lighting plants with capacities from 6-15 Watt Mazda lamps running for seven hours per day up to plant which will supply current for 155-20 Watt Mazda lamps, running eight hours per day, or their equivalent.

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3GP	E. P. Amig, Highland Park, Upper Darby, Pa	972
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3GR	R. M. Wood, West 41st St. and Park Heights Ave., Baltimore, Md	974
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3JJ	F. J. Bergmann, 1310 Allegheny Ave., Philadelphia, Pa	1044
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3JL	E. R. McCaskey, 1029 Main St., Darby, Pa	1046
3JM	L. Freedom, cor. Franklin and 14th Sts., Baltimore, Md	1047

CORRECTIONS

In our June issue: Richard Schell, Jr.'s call should be 2BF, and E. M. Mowton's call should be 2BG; J. H. Whitson's call should be 2BW and F. R. Brick's call should be 2BX. Also the address of B. W. Bartlett (2GB, license 458) should be Westfield, N. J.

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Advertisements for the August issue must be in our hands July 1st.

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WANTED—A PAIR OF BRANDES SUPERIOR phones, and a 1 to 1½-inch coil, for detectors, minerals, variable condenser, fixed condensers, very sensitive galvanometer, adjustable ½ kw. spark gap, medical battery, and other instruments. C. Russel Witmer, Sellersville, Pa.

A BRAND NEW 110 V. A. C. ABOUT ½ H.P., speed 3,000 r.p.m. and a $2.25 interrupter; also a $5.00 Kodak, takes 3¼ x 3½, cost of all, $15.00; in exchange for a 1 kw. helix (not home made) or a good Halcun rotary gap or a 20 ampere "Boston" key. Chas. S. Peete, Bowling Green, Ky.

TO EXCHANGE—I KNAPP S DYNAMO AND primary and secondary of ½-inch Bull Dog Coil for loose coupler, 1 copper pyrite, 2 malhydenite, 1 corborundum crystals for binding posts. F. Grey Daly, Anamosa, Iowa.

"BLITZEN" TUNER AND LOADING COIL, Perikon-electrolytic set with precision potentiometer, Thordarson H2 transformer, Chambers 10 amp key, United Type aerial switch on marble base, X-Ray tube and stand never used, worth $8.75, will exchange for $60 Racycle. Also want folding Kodak. Wm. J. Alexander, Everett, Pa.

WILL EXCHANGE ONE 150-OHM SOUNDER, one-inch spark coil and a transformer for 110 volts, step down three variations, 6, 12 and 18 volts, for a pair of 3000-ohm receivers. Murdock's preferred. Herman Kratz, Jr., 2001 W. Pratt st., Baltimore, Md.

FOR EXCHANGE—5 H.P. GASOLINE ENGINE (air cooled) for wireless instruments, 110 volts, 60 cycle A. C. motor, storage battery, or what have you in the line of wireless instruments. D. Knox Cooper, 239 Westminster Rd., Rochester, N. Y.

FOR EXCHANGE—A 2 V. 10 A. H. STORAGE battery, 75 ohm receiver and cord. Little Hustler motor, Junior fixed condenser, Standard detector, wireless and electrical books and magazines, also other articles. Would like a Brandes Superior phone, fixed condenser, or anything for a receiving station. Glenn England, Havana, Illinois.

WILL EXCHANGE MECHANO NO. 1 SET, cost $2; 20-ohm sounder, cost $2; book on running of dynamos, cost 30c., for ½ kw. coil, 2000-ohm head set or receiving transformer; also 110 volt a. c. fan motor for ½ kw. coil, 2000 ohm phones, or other instruments. Harold Williams, Comanche, Texas.

HAVE A LARGE MURDOCK VARIABLE CONdenser to exchange; also a 5-kw. wireless key, with pure silver contacts, double slide, Murdock tuner, and a lot of brass and fibre stock. Chas. W. Walker, Jr., La Salle and Elm, Chicago.

WILL EXCHANGE A NEW REVOLVER, WITH 3-inch barrel, 22 cal., break down, nickel plated, for Brandes 2000-ohm head set or 2-inch coil. Oscar F. Olson, Fenton, Iowa.

WILL EXCHANGE SCOTT'S 71ST EDITION stamp catalogue; foreign and U. S. postage stamps, telescope, etc. Anthony J. Krynski, 380 East 138th St., New York City.

THORDARSON WIRELESS TRANSFORMER, ¼ kw., cost $22, never used; want new or slightly used storage battery of reputable make; have also a marble switchboard, mounted with a hot wire meter, helix of edgewise wound copper bar, 2 special polished Perkins knife switches, and Clapp-E. power variation switch. H. E. Rawson, 83 Brattle St., Cambridge, Mass.

TO EXCHANGE—1 SELF-INKING TELEGRAPH register, excellent condition, value $70; 20 rolls tape for same; 1-in. spark coil, new; 1 helix; for wireless instruments. C. O. Flint, 72 Spring St., Newport, R. I.

WILL EXCHANGE 1 PAIR OF BRANDES Navy type phones for Eastman's folding pocket kodack or other photographic instruments; phones have never been unpacked from shipping box. R. D. Magann, 1117 Valmont St., New Orleans, La.

I HAVE TO TRADE A 110-VOLT DYNAMO, worth $6, in good condition, which I will trade for a good Eastman vest-pocket camera; I also have other electrical goods I will trade. Philip G. Pedicord, Olathe, Colo.

WILL EXCHANGE FOR ANY STANDARD make motor cycle the following: 1 arc lamp without globe or casing; 110 v. 5 amp., 1 6 v., 60 amp. storage battery; 1 large direct current dynamo; 10 v. 50 amp., 725 amp., 250 v. D. P. S. P. switches, and 1 100 amp., 440 v. switch; 2 snap switches; an electric engine; 1 pocket voltammeter; 100 new battery connectors; a lot of insulators, sockets, snap switches and fuse blocks, and a number of rheostats and some other things. Robert Perrick, 216 Washington St., Montgomery, Ala.

WOULD LIKE GOOD SPARK COIL, AUDION bulb, rotary condenser, in exchange for a Thomson 5-amp, carries 50 per cent. overload; recording wattmeter, working on either 110 A. C. or D. C.; in perfect condition, originally cost $12. H. D. Stephens, Box 137, New Hartford, Conn.

A RELSO AUTOMATIC FISHING REEL; SIreno auto horn ($25); automatic gas lighter with coil and double push button; helix frame, 13½ in. h. 10 in. diameter; Stevens "Crackshot" rifle; 2 ½-in. coils and 1 ¼-in. Mesco coil; helix wound with No. 6; 12 in. high by 5 in. diam.; 2 1000-ohm receivers; any quantity of mercury; Dietzger mechanical drawing set of 4 pieces; telephone ringer for a desk phone; a heavy liquid hydrometer; also cardboard tubes, tuners, buzzers, bells, buttons and sockets. D. Hutchinson, 504 West 15th St., New York.

WILL EXCHANGE 1-INCH COIL FOR GUN. H. W. Heyman, 126 William St., East Orange, N. J.

WILL EXCHANGE FOR WIRELESS GOODS 1 10-volt dynamo, 1 Mirescope projector, postcard, and 6 flashlights. Leon F. Muckey, Box 12, Whitesville, N. Y.

WILL EXCHANGE 1 G. M. DODGE MORSE learners' outfit, with instruction book, and 2 telegraph sounders; want storage battery, small water-power dynamo, Blitzen rotary variable condenser, Blitzen receiving transformer, 3000 ohm phones or technical books. Edwin R. Willard, Jr., 143 West 78th St., Seattle, Wash.

WILL EXCHANGE FOR WIRELESS OR ELECtrical apparatus 2 intercommunicating house telephones, minus receivers; both telephones have switchboard, which will allow 5 telephones to be used on the line; also have a $24 violin and $7 bow; would like a pair of 3000-ohm wireless phones for violin and bow. Lewis W. Williams, 207 Grace St., Wilmington, N. C.

COMPLETE SENDING AND RECEIVING OUTfit; ¼ -in. coil sending outfit is almost new; will exchange for a good hot wire ammeter or something of equal value; also have 150 ohm relay, cost $4.25. Stanley Strauss, 5225 Lexington Ave., Chicago, Ill.

WILL EXCHANGE — 2 SECONDARIES FOR spark coil; will throw 1 inch on 110 v. A. C.; wound with bare wire; will exchange for electrolytic or peroxide of lead detector. Thomas O'Brien, Nassau Ave., Freeport, N. Y.

WILL EXCHANGE—1 GOODELLS IMPROVED lathe and scroll saw, in good condition, for F. B. Chambers inductive tuner or Clapp-Eastham, Blitzen or improved receiving transformer. J. L. Knapp, Evansville, Wis.

HAVE ½-KW. TRANSFORMER WITH VIBRAtor, June supplement oscillation transformer, spark gap, condensers, key, double-throw, double-play switch; instruments valued at $20; would like set of 3200 ohm phones, variable condenser, rotary or other receiving instruments. E. F. Rogers, 710 Washington St., Portsmouth, Va.

WILL EXCHANGE 10 COPIES OF SCHNELL astronomy for key and sounder. Frank Copeman, 1253 Amsterdam Ave., New York City.

WILL EXCHANGE—1 home-made loose coupler; 1 tuner, 10 in. long; 1 Brandes receiver, 1000 ohm; 2 ¼-in. spark coils—1 E. I. and other Mesco—2 D. P. D. T. switches; 1 Edison Battery motor; 1 6-v. Mesco dynamo; 6 8-in. Geisler tubes; for scientific instruments. M. P. Schlosser, 11 River Ave., East Portchester, N. Y.

IN EXCHANGE FOR OTHER ELECTRICAL apparatus I offer a 1-in. coil, interrupter, helix, ⅛-h.p. motor for 110 v. A. C., a head peroxide detector, potentiometer, 1000 ohm phones, 2-slide tuning coil, fixed and variable receiving condensers, a coherer and relay. W. Campbell, Hotel Richmond, Little Falls, N. Y.

ONE WINCHESTER REPEATING RIFLE, practically new, ¼ lb. helix wire, aluminum, size 6, to exchange for 2000 ohm receivers with head band, or loose coupler with variable condenser. Elmer Lewis, Leverne, Okla.

WANTED—A FOLDING KODAK, ABOUT 3¼ by 4¼, and outfit, in exchange for a wireless outfit, consisting of a 130-ft., 4-wire aluminum aerial, 2-slide tuner, crystal detector, fixed receiving condenser, 1-in. spark coil, spark gap, sending condenser, and 20 ft. of copper wire ⅛ in. diameter. Frank Pallotti, 50 Otis St., Hartford, Conn.

WILL EXCHANGE FOR GOOD ½-KW. TRANSformer the following: 1 Blitzen condenser, 1 leather-covered head band with 6-ft. cord, 1 small battery motor, 1 telephone induction coil, 1 pair of experimental coils, 1 telegraph key and sounder, 1 6-point switch with hard rubber base, 1 strap key and 1 tuning coil. Luman Cook, 766 Lotus Ave., Toledo, Ohio.

I HAVE A HIGH-GRADE WIRELESS SENDING and receiving set, which I will exchange for a gasoline motor of over 4 h.p. over either air or water cooled; any one having an engine to exchange will do well to write to me. James Laier, 521 N. Wheeling, Kansas City, Mo.

HAVE $8 MURDOCK LOOSE COUPLER, BRANdes Transatlantic phones, small Porter motor, E. I. fixed condenser; also other apparatus; would like Blitzen tuner, large Murdock loose coupler, No. 2 omnigraph or spark coil. D. MacDonald, 43 Fourth Ave., Brooklyn, N. Y.

WHAT HAVE YOU TO EXCHANGE FOR complete wireless receiving and sending station, guaranteed to give satisfaction; cost $175 to erect; everything first-class; also No. 4 Smith Premier typewriter, equipped with first ribbon, for which I paid $112.50. If interested, write Geo. H. Keyser, Hazelhurst, Pa.

HAVE COMPLETE WIRELESS OUTFIT, CONsisting of 2-in. Mesco coil, key, gap, 4-volt, 30-a.h. storage battery, quick action antenna switch, galena and perikon detectors, double-slide tuner, loose coupler, fixed condensers, potentiometer, voltmeter, 2000-ohm phones and 30-foot, 8-wire antenna, spreaders and poles to exchange. W. Ingraham, 91 Sterling Pl., Brooklyn, N. Y

WANTED—2-IN. SPARK COIL; HAVE IN EXchange drawing outfit; been slightly used; purchased from Technical Supply Co., Scranton, Pa.; value $13.50. O. H. Kent, Osgood, Mo.

WILL EXCHANGE LOOSE COUPLER, 1ST class, for 1 set Brandes 2000 phones or 2-in. spark coil. James Gilligan, 243 Marion St., Brooklyn, N. Y.

ELECTRO LOOSE COUPLER IN EXCHANGE for Fleming valve, or something electrical. Call or write, W. A. Loepel, 930 Columbus Ave., New York City.

WILL EXCHANGE 1 MESCO 75-OHM REceiver, 1 medical coil, Electricity and Magnetism, by G. A. Thompson; a Little Scout 22-calibre rifle, and Stories of Inventors, for a good loose coupler or a spark coil and gap. R. G. Devaney, 196 Murray St., Binghamton, N. Y.

WANT A GOOD PAIR OF WIRELESS REceivers in exchange for other articles. F. M. Giffin, 33 Manchester Ave., Paterson, N. J.

WILL EXCHANGE 150-MILE RECEIVING SET, complete, on base; 1 8-plate, 7½ by 7½, glass condenser; can be adjusted; 1 4-bridge telephone magnet, very powerful; 1 75-ohm receiver; 1 good spark gap; for 2000-ohm receivers, Brandes preferred, or 1½ or 2 in. coil, or 6 volt, 60 amp. storage batteries. Arnold E. Schwarz, Amboy, Minn.

HAVE PAIR 1000-OHM BRANDES PHONES, inch coil, 2 leyden jars, D. P. D. T. switch, spark gap, Ferron detector, Murdock fixed condenser; would like a kodak or other instruments in exchange. Wm. Heyer, 102 Central Ave., Newark, N. J.

WILL EXCHANGE A COMPLETE WIRELESS outfit, aerial, wire and lightning switch included, for good typewriter, Remington or Underwood preferred. Howard C. Mitchell, 2334 Columbia Ave., Philadelphia, Pa.

WILL EXCHANGE LOOSE COUPLER, 12 TAPS on secondary, 2 slides on primary, new, for one pair of Brandes Transatlantic, 2000 ohms. J. Kertz, 76 Fleet St., Brooklyn, N. Y.

WANTED—WIRELESS RECEIVING SET, 2000-mile range, or tuning coil and other receiving parts of equal capacity; have for exchange fine clarinet, practically new, cost $21 wholesale; Remington gun, 7-shot, take down, used twice, cost $22; or most anything in the jewelry line. W. F. Poole, Wallowa, Ore.

WANT FOLLOWING BOUND VOLUMES, IN good readable condition: Modern Electrics: Volumes 1, 2, 3, 4 and 5; will exchange wireless goods of equal value. Address Charles H. Faust, Long Prairie, Minn.

WILL EXCHANGE 2 PRINTING PRESSES, size 3 x 5 and 2 x 4; have 2 rollers, self-inking; also type and cases; worth $15; want wireless outfit, 1-in. spark coil or Bennet typewriter. A. E. Glawe, 20 State St., Wanwatusa, Wis.

ONE ½-KW. TRANSFORMER COIL AND 1 INterrupter; want Blitzen rotary condenser; coil has never been used. Irwin Ellestad, Lanesboro, Minn.

WILL EXCHANGE A MURDOCK $15 LOOSE coupler, silicon and galena detectors in cabinet, $4.50; complete assembled woodwork and tubes, nicely finished, value $1.50, and 7 ft. green silk double receiver cord, 75c; trade value of above, $18; everything excellent, except loose coupler is minus secondary winding; can be replaced for 25c. Howard S. Pyle, 3316 York Rd., Seattle, Wash.

HAVE ½-KW. TRANSFORMER WITH VIBRAtor, sending condenser, June Supplement Oscillation Transformer, key, spark gap, and D. T. D. P. switch; want Blitzen wavemeter, variables (rotary), 3200-ohm phones or Blitzen tuner. Edward Franklin Rogers, 710 Washington St., Portsmouth, Va.

WILL EXCHANGE A NEW RADIOPTICON post card projector, operating with 2 Mazda tungstens on 110-volt circuit; cost me $9; for a good loose coupler, a Ferron detector or other wireless apparatus. Joseph T. Goodman, 1763 Fulton Ave., Bronx, N. Y.

WILL EXCHANGE LOOSE COUPLER, COST $5; variable condenser, cost $10; 4-volt storage battery, cost $5; also wireless box, has 7 switches rheostat, 2 detectors, place for 3 variables, polarity changer, all mounted on hard rubber front, for wireless apparatus. Frank Merritt, 28 Spring St., Red Bank, N. J.

WANT AN AUDION DETECTOR OR A GOOD sending condenser in exchange for a good storage battery and other wireless goods. George D. Buchanan, care The Ashton Valve Co., Boston, Mass.

WANTED—A GOOD VARIABLE CONDENSER or other apparatus for a good foot-power scroll saw, in fine condition. S. Anderson, Jr., 150 Manhattan Ave., New York City.

WILL EXCHANGE A NEW WESTERN ELECtric (patent) relay, 150 ohms, 5 posts, for a camera, in good condition; will add $2 motor and some wireless apparatus if camera is exceptionally good; state particulars. Martin Levy, 9 Bradford St., Brooklyn, N. Y.

TO EXCHANGE—1 47-PLATE ROTARY CONdenser, 1 Brandes Navy type head set, 3200 ohms, and 2000-ohm receivers; all in A1 condition; want a rotary spark gap, Murdock loose coupler or Ferron detector. E. H. Jenkins, 251 Home Ave., Oak Park, Illinois.

LATHE, GOODELL-PRATT MAKE, COMPLETE, with tail stock, tee rest, face plate, saw oiler, taper threaded polishing spindle, and 3-jawed chuck; capacity 0 to 5-32 inch; set of buffers and 1 emery wheel; can be driven by 1-6 h.p. motor and ¼ round leather belt. J. B. Story, Chillicothe, Ohio.

I HAVE A HOLTZER-CABOT MOTOR, 1-5 H.P., 110 volts, 900 r.p.m on 60 cycles, and a ribbon type oscillation transformer, for use up to ½ kw., to exchange for a pair of Brandes Navy type phones, in good condition, or a 1-20 or 1-30 h.p., 110-volt, 60 cycle motor, with a speed of about 3400 r.p.m. Frank J. Corey, 41 Sycamore St., Somerville, Mass.

WILL EXCHANGE FOR A GOOD RECEIVING and sending set the following: 70 cloth-bound books, cost 30c each; 125 cloth and paper bound books, at 10c each; 1 coaster brake, cost $5; 1 fountain pen, and other things; value of articles named is $40; will exchange, separate, for wireless or electrical instruments; best offer takes bargain. Geo. W. Trammell, Jr., 308 E. Sixth St., Rome, Ga.

HAVE 100 4 BY 5 PLATES, GOOD FOR CONdensers, and a set of aviators' books; would like a good water motor or a spark coil. Charles Kiley, 559 West 42d St., New York City.

WILL EXCHANGE 8 TO 10 MILE SENDING set, consisting of 1-in. coil, electrolytic interrupter, sending condenser, and wireless key, for a set of latest type Holtzer-Cabot or Brandes Transatlantic phones, or good hot wire ammeter. Marcus Frye, Jr., Box 187, Vineland, N. J.

WILL EXCHANGE ALMOST NEW J. B. BUNnell $12, 150 ohm telegraph key and sounder for wireless goods. James J. Nolan, 99 E. Brookline St., Boston, Mass.

WANTED—2000 OHM PHONES, AUDION, CONdenser, etc.; have all kinds of telephone parts, lightning switch, small ammeter, etc. Ralph Batcher, Toledo, Iowa.

A LARGE WIRELESS RECEIVING AND SENDing set in exchange for a good make typewriter, in good condition. Edmund Kimmel, 24 Kensington Pl., East Orange, N. J.

WHAT HAVE YOU IN EXCHANGE FOR 1 new automatic gas lighter, cost $3; 1 7-inch fan, 1 home-made loose coupler primary 6 inches long, 4 inches in diameter, single slide, secondary 5½ long. 3½ in. diam., 8-point switch on secondary, a 3-inch Geissler tube; also have a piece of silicon and carborundum for a piece of Ferron. Joseph Knieriemen, Atco, N. J.

FOR EXCHANGE—1 PHONOGRAPH, MODEL D; moving picture machine; gas generator and films; valued at $10; in exchange for wirelesss apparatus. James E. Rice, Jr., 567 Plymouth Ave., Rochester, N. Y.

WILL EXCHANGE 1 5-BAR TELEPHONE magneto, very powerful, for 1 1500-ohm receiver, or what you have. Floyd Dwyer, Straw, Mont.

WANTED — A 12-GAUGE REPEATING OR automatic shotgun; make no object; in exchange for modern wireless apparatus of various makes. Eben W. Erikson, 421 Linden Ave., Winnetka, Ill.

WILL EXCHANGE FOR A MURDOCK OR Blitzen rotary variable condenser: The Putnam Hall Rivals, Putnam Hall Rebellion, Putnam Hall Encampment, Putnam Hall Mystery, Motor Boat Club of Kenebec, Motor Boat Club at Nantucket. Donald J. Morey, 1338 Main St., Racine, Wis.

5-BAR GENERATOR, 1600-OHM BELL, TRANSmitter and arm, 75-ohm double-pole receiver, condenser, telephone switch, automatic relay with plug, value $10; will trade all or separate; want electric whistle, buzzer, rheostat regulator, small gasoline torch, micrometer, static machine, etc., or generator. Albert J. Weinsz, 327 W. Fourth St., Canal Dover, O.

WILL EXCHANGE A MURDOCK HELIX, 2 sending condensers, cost $8; perikon, galena, silicon detectors, cost $7; double-slide tuner, cost $2.50; 2 fixed condensers; all in perfect condition; for a Blitzen receiving transformer or a Blitzen variable and Ferron detector, and a pair of Brandes $9 phones or something of equal value. Sanford H. Potter, 211 Summer St., Buffalo, N. Y.

WILL EXCHANGE A STEVENS SINGLE-BARrel shotgun, as good as new, and a wireless telegraph key, for electric post card machine of equal value; the gun cost $12; I will pay the duty on the gun to the United States. Address Herbert L. Walsh, Niagara-on-the-Lake, Ont., Canada.

WANTED—PAIR OF BRANDES TRANSATLANtic or Navy type phones, in exchange for anything you wish of equal value; phones must be in good condition; also photographic supplies to exchange for anything of equal value in wireless. R. Greer, 536 N. Marshall St., Philadelphia, Pa.

WILL EXCHANGE C. E. ¼-KW. TRANSFORMer, M. U. loose coupler, M. U. variable, e. i. rotary variable condenser, 1000 Brandes phone, perikon detector, aerial switch, helix, condenser, for ¼-kw., 12-in. fan, for a large wireless transformer, or something of equal value in the wireless line. M. T. Lawrence, 406 West 10th St., Austin, Texas.

WILL EXCHANGE 1-IN. COIL FOR BLITZEN receiving condenser; also have an auto coil with large platinum contacts on vibrator, value $5; gives ¾ to 1 in. spark; will trade for Brandes 2000 ohm phones or a good receiving transformer or storage battery. Paul Schmidt, 412 East Ave., Hamilton, Ohio.

HAVE STORAGE BATTERY, 6 V., 40 A. H. set of Mesco telegraph instruments and new Stevens rifle, to exchange for 2000-ohm phones or good loose coupler or double-slide tuner. C. Don Martin, Box 162, Rautool, Ill.

HAVE FOLDING CAMERA FLASHLIGHT; also books and magazines; will exchange for loose coupler, or receivers or electrical goods. A. Roy Rupp, Box 1, Wooland, Wyo.

FOR EXCHANGE—1 HUNT & McCREE 3-SLIDE tuner and fixed condenser, 1 1-in. spark coil and Universal detector stand; also a telegraph key and 5 new dry cells; also a $12 carbide moving picture machine, for a coaster-brake bicycle. W. F. Grimes, 17 Hammond St., E. Gloucester, Mass.

WILL EXCHANGE A KENDRICK & DAVIS motor and dynamo motor, 3-bar A. C. magneto, a nickel-plating outfit and potentiometer and a Niagara water motor, for a folding camera, Ferron detector, or other wireless apparatus. Paul H. Button, 437 McMillan Ave., Detroit, Mich.

WILL EXCHANGE FOR SCIENTIFIC ARTIcles, 1 key and sender, 1 book entitled "Hapters Electricity Book for Boys," and 7 numbers of Modern Electrics, starting with June, 1912. Otto Hinsch, Wenatchee, Wash.

WANT BACK NUMBERS OF MODERN ELECtrics in exchange for wireless articles. F. H. Ashton, 271 Franklin St., Boston, Mass.

FOR EXCHANGE—ONE TYPE C VOLTAMP motor, one 4 ohm giant sounder, a powerful 3-bar generator; a bell; 2 telephone receivers; a Coherer. Will exchange for a spark coil. Sol McDavid, Hillsboro, Illinois.

110 VOLT A. C. ELECTRO POWER MOTOR, lathe turned r. s. g. wheel, variable condenser plates, battery motor, 2 sounders, key, loose coupler with primary 5 x 6 in., No. 24 enamelled wire, secondary 4½ x 6 in., No. 28 enameled wire. Has 6 binding posts, oil-tight box l. d. 8½ x 12 3¼ in. fitted and glued together without screws. Want induction motor, high grade variable condenser, or other apparatus. Laurence Rice, New Durham, N. H.

WILL EXCHANGE THE FOLLOWING FOR A 2-in. Bull Dog Spark Coil: ¼ in. spark coil, 6 Leyden jars and stand, 1 wireless telegraphy key, 1 switch, 1 reverse switch for motor. Arthur Haake, Closter, N. J., Bergen County.

WILL EXCHANGE 1 MAGNETIC OIL BREAK key, 1 giant sounder, 1 resonator, 1 160 ohm relay for a good 4-inch spark coil. A Stewart, 1367 W. Lake st., Chicago.

TO EXCHANGE 20 MAGAZINES (NOV. 11-May 13) for half-inch coil or the 20 volumes and a mission style wooden rack for a one-inch coil. Will also exchange 2 books, "The Boys' Book of Model Aeroplanes," "Model Flying Machines." Coil must be in good order. J. E. Butler, La Grange, Ky. P. O. Box 77.

WILL EXCHANGE A ROTARY SPARK GAP, motor, control switches, rheostat, complete, for variable condenser, either Blitzen or Murdock. Have a six-inch single stroke bell, a portable set, and other apparatus. Harold Bibber, 31 Beacon st., Gloucester, Mass.

WANTED—A PAIR OF 2000 OR 3000 OHM receivers, a rotary variable cond. Blitzen tuner, or other apparatus. I have for exchange, a large loose coupler, 2 slide tuner, 2 detectors, variable and fixed condensers, and an oscillation-transformer. A Perkins, 4008 West Prospect st., Kansas City, Mo.

WILL EXCHANGE 1 SAMSON BATTERY, value $1, and 1 medical coil, value 75c., for an "Ever Ready," "Elite," or any good volt ammeter. I. Spencer Page, 1027 E. Oxford st., Phila., Pa.

WILL EXCHANGE .22 CALIBRE, HAMMERless, repeating Savage rifle, good as new. Value $12.00, for a 110 volt. A. C. motor of equal value. John C. Boggs, 824 N. Beard st., Shawnee, Okla.

CHEMICAL GLASSWARE FOR ITS VALUE IN any kind of wireless goods, preferably No. 24 enamelled wire, or a tuner. Mackey, 311 E. Lancaster ave., Wayne, Pa.

TO EXCHANGE—LARGE TESLA COIL, SMALL self-inking printing press, complete, bicycle gas light, automobile gas generator, telephone parts, and other electrical goods, for anything I can use in electrcial or mechanical line. C. A. Babb, Abingdon, Ill.

WILL EXCHANGE A "NEW FERRON DEtector," also Perikon detector for other instruments. E. A. Lindecrantz, 120 Belmont st., Worcester, Mass.

I HAVE A DOUBLE SLIDE TUNING COIL, one buzzer, one 50c. condenser and one 75c. ohm receiver all in good condition; will exchange for a small Kodak or Brownie camera. W. Eggers, 424 Perry st., Detroit, Mich.

WILL EXCHANGE A SELF-INKING, FOOT power job press for a first class wireless receiving outfit. Range to be not less than 1,000 miles. Press in good condition. Leslie Jones, Charlestown, Ind.

SMALL A. C. MOTORS, ELECTROLYTIC rectifier, Morse recorder, ½ h.p. boiler and engine, Nerst lamp, volt and ammeters, electric iron, Winchester rifle, electric clock, 1 k.w. closed core transformer and other wireless apparatus; send for list. Exchange for lathe, drill press, other electrical apparatus or gasoline engine. What have you? W. H. Frasse, 230 St. James Place, Brooklyn, N. Y.

IRON PIPE AERIAL MAST WANTED IN EXchange for 15-volt, 10-ampere generator. Edward French, Peekskill, N. Y.

WILL EXCHANGE $10 MICROSCOPE FOR 1½-in. spark coil, Blitzen variable condenser and wireless key, or wireless apparatus. Condit Allstrom, 46 Chestnut St., East Orange, N. J.

WILL EXCHANGE A COMPLETE HIGH-GRADE wireless station, sending about 8 miles, receiving 1,000 to 2,500 miles, and ¼-h.p. gasoline engine, for motor cycle. Laurence H. Reed, 116 Conewango Ave., Warren, Pa.

WILL EXCHANGE PYROGRAPHY SET, NO. 2 Brownie camera, drawing board, T square, and set of instruments for loose coupler, detectors, variable condensor, or other wireless instruments. H. C. Barker, Box 1605, Boston, Mass.

WILL EXCHANGE 50 COPIES OF SCIENTIFIC and electrical magazines for electrical or wireless apparatus. John Burhitt, Modoc, Ont., Canada.

WILL EXCHANGE ¼-KW. TRANSFORMER core or electrolytic detector or helix (spiral), or 2-slide tuning coil, for 1 superior Brandes receiver. Harold Winningham, 3701 No. 18th St., Tocoma, Wash.

WILL EXCHANGE 1 ALUMINUM LEVER Giant sounder, 4 ohms, in A1 condition, for Western Union single or 2-line plug board. Chas. E. Holmes, 310 W. Brown St., Grand Rapids, Mich.

WILL EXCHANGE C CORNET, COST $15, with attachments, never used, for ½-kw. coil, with good vibrator, and Mesco No. 474 fixed condenser; also want variable condenser, February and August, 1912 Modern Electrics, and electrose lead-in to test 35,000 volts rain test. Alvin C. Spencer, Magnolia, Illinois.

WILL EXCHANGE GOOD MAIL ORDER BUSIness, paying 90 per cent. profit, including scheme, outfit, etc., for printing press and outfit; have stamp collection worth about $100; also electric thriller, switch, 2 sockets, and complete course in moving pictures, for whatever you have. P. K. Lovegren, 1305 Ashmun St., Burlington, Iowa.

1 KW. IMPEDANCE COIL, 8 STEPS & KW. Helix, 1000 ohm received and headband, and Premvette camera. All O. K., in exchange for ½ kw. transformer or "Amco," quenched gap. A. E. Dudley, N. Abington, Mass.

TO EXCHANGE — 1-KW. CLOSED CORE transformer condenser, oscillation transformer, 5-kw. muffled spark gap, 3-slide tuner, commercial; 1 loose coupler, value $10; 1 perikon, 1 ferron detector condenser; would like graflex plate camera and good lense, or gasoline engine. John E. Maloney, 1375 Carroll Ave., Chicago, Ill.

WANTED—BRANDES NAVY TYPE PHONES, new, or new Blitzen ring tuner, in exchange for loose coupler, detector, spark gap, small wireless receiver, telephone receiver, 2 telegraph keys, D. P. D. T. switch, parts of split head band. Emile Hirsch, 105 East 106th St., New York, N. Y.

PEATTS 19TH CENTURY STAMP ALBUM, newly rebound with leather back and corners, worth $2, for a good potentiometer or detector; 15,000 die cut hinges, 10 approval books, 5 collector catalogues for Modern Electrics, April, 1912, to January, 1913, and switches. Winslow Cole, 86 Amherst St., Washau, N. H.

HAVE CHAMBERS 1-IN. SPARK COIL, THAT is almost new; also a double-slide tuning coil, 16 in. long, to use as loading coil; I would like to exchange both for a pair of Brandes Navy phones or the spark coil alone for a pair of Superior type phones. M. E. McClintoch, 93 Seventh St., Salem, N. J.

STEREOPTICON, WITHOUT LIGHT, IN BEST condition, cost over $50, to trade for step-up transformer of reliable make, variable condenser, good phones, loose coupler, or any good instruments. Albert MacDonald, 724 Portage Ave., South Bend, Ind.

TO EXCHANGE — 19-PLATE ROTARY CONdenser and Marconi 3000 ohm head set, for an Arnold audion set, peroxide of lead detector, and a Schrader Universal tire pressure gauge, or anything in wireless line. Paul J. Hoffman, 1688 Second Ave., New York City.

WANTED TO EXCHANGE, 4x5 PLATE CAMera outfit, complete, 1 flashlight, 1 $2 book on automobile running and repairing, 1 Washburn guitar, $25 new, for wireless goods. A. Ray Rupp, Box 1, Worland, Wyo.

A $25 SET OF WIRELESS INSTRUMENTS, both sending and receiving; will exchange for cornet, Lyon & Healy make; must be in good condition; also of equal value; write description. H. Dahlquist, 1434 Balmoral Ave., Chicago, Ill.

WILL EXCHANGE A TELEGRAPH SOUNDER and key for wireless instruments. Wm. Theobald, 729 East 163d St., New York City.

WILL EXCHANGE FOR A 1912 MOTORCYCLE, in good condition, or a good A. C. 110-volt, 60-cycle motor, a complete sending and receiving set, tested, consisting of double slide tuning coil, detector, 1 large, 1 small fixed condenser, pair Brandes phones (new), D. P. D. T. switch, 1-in. coil, spark gap, adjustable sending condenser, helix, key, interrupter, choke coil, fuse block and switch, for scientific instruments. John W. Pow, 139 N. Front St., Steelton, Pa.

TO EXCHANGE—A LARGE LOOSE COUPLER and a Blitzen rotary tuner for a good pair of phones, 2000 or 3000 ohms, or a Murdock or Blitzen rotary variable condenser. Victor Greischar, 4009 Holly St., Kansas City, Mo.

WILL EXCHANGE A COMPLETE LEYDEN jar stand and 6 leyden jars for it; this instrument cost $2.50 when new; will exchange it for anything in the line of wireless goods. Arthur Haake, Closter, Bergen County, N. J.

WILL EXCHANGE NEW PEROXIDE OF LEAD detector and potentiometer for split head band, double. Roy Wolf. Plymouth, Wis.

WILL EXCHANGE 400-MILE WIRELESS RECeiving set, complete, with 50 ft. aerial, 4x5 folding camera and outfit, and rifle, for standard wireless instruments. Charles M. Rider, 11 Park St., Springville, N. Y.

FOR EXCHANGE — $4.75 BALDWIN POST card projector, acetylene, good condition; peroxide of lead detector, perfect condition; $1.25 potentiometer, perfect condition; 1000-ohm phone and head band, cost $2.35; cloth-bound Operator's Wireless Telegraph and Telephone Handbook, cost $1, good condition; want good loose coupler. Geo. H. Barnes, Meigs Corners, Quebec, Canada.

NEW FILM TANK DEVELOPER, WITH INstructions; takes rolls 4x5 or smaller; 1 Audible transmitter, for teaching telegraphy, including 4 double records with regulation messages (Morse); 1 small new Rex battery motor; in exchange for heavy wireless key or wireless instruments worth $3.25. Frank D. Fallain, 319 First Ave., W., Flint, Mich.

WHAT HAVE YOU TO EXCHANGE FOR 1,000 ft. or less of 7-strand, 22-gauge tinned copper antennae wire; value about ¼c ft.; need tuning coil, 1000-ohm receiver, variable condenser, aerial switch, or small A. C. motor. Frank Marshall, Uptown Station, Pittsburg, Pa.

WILL EXCHANGE A LARGE PORTABLE wireless case with Yale lock and keys, tungsten steel horseshoe magnet and a good mandolin, for loose coupler, 3-slide tuning coil, variable condenser or other articles in wireless. Archie Magnuson, R. R. No. 6, Box 67, Spencer, Iowa.

FOR EXCHANGE — 50-WATT DYNAMO, FOR which I would like a set of H-C or Brandes head phones or other wireless instruments; also want ammeter and voltmeter for telegraph sounder and key; have a Witherbee 6-v., 40-a.h. storage battery for wireless instruments. Harry Luckert, 915 Jackson Ave., New York City.

HAVE 1,000-MILE RECEIVING SET, LARGE Edison 110-volt motor, Ajax motor, numerous telephones, induction coils, ferron detector, 75-ampere S. P. D. T. lightning switch, 750 ft. continuous 3-16 inch iron guy wire; want Blitzen or Murdock receiving transformers and condensers. Harold Peterson, Westminster Ave., Arlington Heights, Mass.

WILL EXCHANGE FOR WIRELESS INSTRUments 1 Rex and 1 Little Hustler motor, 1 bell, 2 push buttons, 2 knife switches, 7 Christmas tree bulbs and sockets, 2 "Mesco" and 2 Red Seal batteries. Edward Burns, 127 East 110th St., New York City.

WILL EXCHANGE NOV., DEC., MAR. AND Apr. electrical magazines for 60c worth of M. E. or a 60c spark gap. Roscoe Cottrell, Prairie City, Iowa.

WILL EXCHANGE NEW 4x5 PLATE CAMERA for ¼ h.p. A. C., 60-cycle motor; will also exchange electrolytic detector, potentiometer, tuning coil, 2, 4 bar generators for a ⅛ h.p. A. C., 60-cycle motor. Austin P. Sanborn, Chapman, Kan.

WILL TRADE 1 ARTIFICIAL LEG, COST $125, used very little, for any kind of electrical goods. Donald Eastham, 515½ Northrup St., Portland, Ore.

WILL EXCHANGE 1 BRAND NEW "EVER Ready" ammeter, tests 0-35 amperes, price $1.50; 1 Starret wire gauge, in good condition, cost $2.50; 1 85-ohm solid double pole receiver and cord, almost new, value $1; for a double head band 2000-ohm set. Thomas A. Hawley, West Eighth St., Hanford, Cal.

WILL EXCHANGE A ½-INCH SPARK COIL; also telegraph instrument, including key and sounder; all in excellent condition; for a 110-v. direct current motor. Leon Pennell, 69 N. Main St., Brockton, Mass.

WILL EXCHANGE A COLLECTION OF INdian relics; also 2300 feet aluminum wire; for small lathe or wireless apparatus. J. B. Ragatz, Yountville, Cal.

WILL EXCHANGE 2½-IN. JUMP SPARK coils, fixed condenser, electrolytic detector, marble base, mineral detector, double-slide tuning coil, 2 1-qt. leyden jars, 1 lb. paper condenser, 2 watch-case ammeters, 6 v., 60 amp. storage battery, variable condenser frame, no plates, for stationary engine. Chas. Brown, 125 Bergen St., Brooklyn, N. Y.

WILL EXCHANGE PAIR KLEIN'S CLIMBERS, with straps, new safety belt and tool belt, 35 plate rotary condenser, without case, and other wireless goods, for switchboard voltmeter, Amco loose coupler, 110-v., 60-cycle motor, or other articles; have other goods for Brandes Navy or Transatlantic phones. P. H. Geiger, Marshall, Mich.

WILL EXCHANGE AN "AUTO SPARKER" DYnamo; will deliver up to 15 volts; for pair of high-grade receivers; must be in good condition. A. Ross, R. F. D. No. 2, 323A, San Diego, Cal.

PENZEL B FLAT HIGH PITCH CLARINET, 13 keys, 2 rings; cost $22.50; excellent condition; want 3 Murdock or 2 Blitzen variable condensers, or ½-k.w. open core transformer or 3-in. spark coil in exchange. Dale Clemons, Storm Lake, Iowa.

WILL EXCHANGE HOME-MADE LEYDEN jar, large piece carborundum, nickel-plated buzzer, a large musical top, magic lantern with 5 slides, course in hypnotism, 1 75-ohm receiver, for omnigraph and some good book on how to telegraph. Colby D. Campbell, care Marconi Wireless Tel. Co., Galveston, Texas.

WILL EXCHANGE—HOW TO MAKE A VOLTmeter; Storage Battery; Spark Coil; Telephone; How to Wind Armatures; these 6 books cost 60c; Smith's Wiring Diagrams, 25c; Practical Electricity and Electrical Units, each 5c.; for Books of Modern Library; will also exchange some odd magazines. Hall Moss, Ferris, Texas.

HAVE GOOD PORTABLE RECEIVING SET consisting of 3-slide tuner, 2 detectors, 1 fixed condenser, with necessary switch and binding posts, home-made; will exchange for large key or wireless apparatus. George P. Edgar, Box 646, San Leandro, Cal.

WILL EXCHANGE 75-OHM BI-POLAR RECeiver (new), 1 galena detector with marble base, set of learner's telegraph outfit, for ½-in. spark coil. O. R. Tomann, Ellsworth, Wis.

WIRELESS INSTRUMENTS TO EXCHANGE—Send me a list of what you have to exchange and what you need. Wireless Station, 486 Decatur St., Brooklyn, N. Y.

WILL EXCHANGE D. S. 3000-METER TUNING coil, 2000-ohm phones, 5-ohm sounder, tubular variable condenser, 75-ohm phone, 1-in. spark coil and interrupter for 1,000 ft. copper or phosphor bronze wire and good electrolytic detector with potentiometer, or good rotary variable condenser and detector. F. K. Shield, Jr., Highland Park, N. J.

HAVE PAIR HOLTZER-CABOT PHONES, 3 1-in. coils, ¼-in. Ruhmkorff coil, ¼-h.p. motor, loose-coupler, storage battery, 2-slide tuner; I want a lightning switch, an audion, Blitzen tuner or variables, Thordarson or Blitzen transformers, or Murdock or Amco loose-coupler, or Ferron detector. P. H. Geiger, Marshall, Mich.

FOR EXCHANGE—A COMPLETE WIRELESS course of 20 lessons, in good condition, for a set of guaranteed double-pole Murdock amateur, Brandes or Holtzer-Cabot 2000-ohm receivers, complete, with headband and cord. Halstead C. Terry, Lake Mills, Wis.

HAVE 1 POUND OF NO. 14 ALUMINUM aerial wire, cut in 4 lengths; never used; also 1 pound of No. 6 aluminum helix wire; never used; in exchange for telegraph key and sounder. Harold Hills, R. F. D. No. 4, Fulton, N. Y.

FINE LAW LIBRARY, 12 VOLUMES, NEW; several books never unwrapped; cost $40; will exchange for Blitzen variable condenser and Blitzen tuner or Clapp-Eastham loose-coupled tuner, or for Blitzen variable condenser, Clapp-Eastham fixed condenser and pair of Brandes Navy type phones. Further particulars for stamp. Student, 117 Hanover St., Silver Creek, N. Y.

WILL EXCHANGE A 150-OHM, J. H. BUNNELL relay, a 5-ohm telegraph sounder, and a coherer with automatic decoherer; all practically new; cost price $8.50; for a 2000-ohm Holtzer-Cabot or Murdock amateur type phones or 3000-ohm phones. James M. Shute, Uxbridge, Mass.

WILL EXCHANGE 6-VOLT, 60-AMPERE-HOUR storage battery, cost $25; also ¼-in. spark coil, home-made vibrator with 2 thumbscrews, 75-ohm receiver with headband and cord; want a bicycle with a coaster brake, in good working condition, or Brandes improved navy receivers; must be in good order. Walter Miller, 96 Pitt St., New York City.

WILL EXCHANGE 2 1000-OHM BRANDES phones, with headband and crystal detector for other instruments. Ralph W. Hemple, 408 Excelsior St., Pittsburgh, Pa.

WILL EXCHANGE 1 MAGIC LANTERN WITH slides, 1 22-calibre revolver (7-shot), 1 fishing reel, for 2 receivers (1000 ohm each), with headband and cord. Charles W. Parrott, 44 Pleasant St., Gloucester, Mass.

WILL EXCHANGE HIGH-GRADE WIRELESS apparatus for standard late model typewriter. Write, giving full description of your machine, Crocker Mann, Dover, Mass.

WILL EXCHANGE COMPLETE SHORT DISTance transmitting, long distance receiving set, Remington auto. shotgun, Stevens rifle No. 722, mounted deer head, 6 I. C. S. handbooks, for high-power transmitting and receiving set of any standard make. A. Johnson, 1020 Wells St., Chicago, Ill.

FOR EXCHANGE—1 MOVING PICTURE MAchine, in excellent condition, equipped for either carbide or electricity, complete, with carbine generating tank and fixtures; also some films; all worth over $15; will exchange for a pair of 2000-ohm phones, Brandes or Holtzer-Cabot type preferred; or a rotary variable condenser. Wm. Pinkney, Jr., Rowayton, Conn.

WHAT HAVE YOU TO EXCHANGE FOR A 1-inch coil and a 1½-in. coil? Will exchange separately or together; both coils are in excellent condition. Joseph E. Hamilton, 16 W. Broadway, Port Chester, N. Y.

TO EXCHANGE FOR 1 SET OF NAVY TYPE Brandes receivers, almost new; 2 half-dollars dated 1825 and 1829, and a 75-ohm watch case receiver and receiver cord for instruments. H. Shaw, Savannah, Ohio.

WILL EXCHANGE 1 SET OF LIONEL ELECtric trains, cost $16.50, for something in the wireless line; would like phones or induction coil. Sam Knapp, 89A Cooper St., Brooklyn, N. Y.

HAVE 3-BAR MAGNETO, 10 LBS. 33 BARE wire, parts ½-in. coil, 52-volt alternating fan motor, 2 telephone induction coils, 10 brass sockets, 21 segment new commutator, 5-h.p. starting box, for storage batteries, plates, or what have you? J. Watts, Pearl St., Port Huron, Mich.

WILL EXCHANGE A MANHATTAN ELECTRIC Kent dynamo or motor, cost $10, in good condition and almost new, for a Manhattan electric 2-inch coil or C. Brandes Transatlantic phones. Fletcher Jordon, Lynbrook, L. I., N. Y.

WILL EXCHANGE A ¼-KW. TRANSFORMER, has 2 secondaries and 2 primaries and a spark gap on same, for a 2½ or 3 in. spark coil, in good condition; owner has no A. C. current; also a complete aerial, 10 wire, 50 ft. long; can be made a 100 feet, as the wire is double No. 12 wire; hardwood spreaders and insulators; will exchange for Murdock 2-slide tuner. George E. Jette, Radio Station, 161 Summer St., Central Falls, R. I.

WILL EXCHANGE 1 LARGE TUNER, 1 SMALL tuner, 1 receiving condenser (fixed), 1 heavy current key, choke coil, hand feed arc light, 1-in. coil, for a transformer, loose coupler, phones and other wireless apparatus. Theron G. Skyles, 522 11th St., Astoria, Oregon.

HAVE GILLETTE SAFETY RAZOR, PRACTIcally new; also small electrical apparatus; for 0-50 switchboard voltmeter or 30 volt sewing machine motor or other electrical apparatus. Nevins Arnold, Trezevant, Tenn.

WILL EXCHANGE FOR ANY WIRELESS INstrument sending or receiving or other electrical apparatus, 1 Electro audion, never used, Universal detector, 2 intercommunicating telephones, cost $6 each, 1 1000-ohm receiver, aluminum case, 56 ft. No. 4 solid copper ground wire, never used, 2 ¼-in. Splitdorf automobile coils, Exide, 4-volt, 40-ampere storage battery, new. P. Murawski, 306 22d St., Brooklyn, N. Y.

FOR EXCHANGE AN 80-WATT HYDRO-GENerator set; also a 1½-in. spark coil, almost new; a large fixed receiving condenser, in polished brass case; 1 8-point hard rubber switch, suitable for loose coupler; 1 4-ohm learners' sounder and key; also loose coupler; will trade these for Brandes Navy type phones, omnigraph set or high-grade receiving apparatus. M. Grubman, 1607 Carondelet St., New Orleans, La.

WANT SMALL MURDOCK $3 CONDENSER OR good tuning coil in exchange for a loose coupler; also a 1000-ohm receiver for fixed condenser. John Starrett, 204 South St., Plymouth, Wis.

HAVE FINE STAMP COLLECTION IN BRANDnew album, holds 10,000, value about $40, cyclometer, motorcycle pump and horn, ½-kw. sending apparatus, electrical and raw material; will exchange for factory-made commercial wireless receiving apparatus. Clarence Evans, Somerville, N. J.

TO EXCHANGE FOR HOLTZER-CABOT LIGHTweight 3000-ohm phones, in good condition, a ½-kw. closed core transformer or other wireless apparatus. A. C. Zwicker, 99 Yorktown St., West Somerville, Mass.

WILL EXCHANGE BICYCLE FRAME, SEAT and wheels, electric card photoscope, graphophone and galvanometer for a condenser and 2000-ohm phones. C. Shelley, 4829 N. Paulina St., Chicago, Ill.

WILL EXCHANGE NEW SCOTT'S 198 20TH Century Albums, with 800 stamps, catalogued at $20, for an Improved Navy head set or any good 3000-ohm set, and something in wireless up to $17 value; also 12,000 stamps, 2 years Mekeel's Stamp Weekly, 75-ohm set and some telegraph instruments. Wm. Newton, 820 Worthington Pl., Omaha, Nebr.

I WILL EXCHANGE AN EASTMAN NO. 1 folding pocket kodak, cost $10, a magic lantern, cost $1.50, a Special air rifle, cost $2.50, a carborondum detector, cost $3, and a 1-in. spark coil, cost $4.50, for a H-2 Thordarson wireless transformer, in good condition; I will guarantee my things. Maurice Winglemire, Holly, Mich.

WILL EXCHANGE ½ INCH AUTO COIL, ONE 75 ohm receiver, one No. 2 Brownie camera, value $2.00, one set I. C. S. Mechanical and Electrical Engineering, value $40.00, one "Easy Electrical Experiments," value $1.00; ½-inch secondary, ¼ lb. No. 32 Magnet wire, one home-made time switch, two gravity batteries, one voltamp motor, for wireless of electrical apparatus. Laudie Rose, Hoisington, Kans.

FOR EXCHANGE—1 MARLIN 16-SHOT REpeating rifle, in perfect condition, value $8, for a good ferron detector; also some magic apparatus for what you have of reliable make; also some acetylene carbide lamps; great for camping or fishing at night. John J. Coff, Effingham, Ill.

WILL EXCHANGE 12 BRAND-NEW 60c BOOKS (fiction) and 1 $1.25 book (a wireless story of South America) for a $3 Murdock variable; also 1 fine $24 violin for a $15 Thordarson flexible step-up transformer, in good shape. Lewis W. Williams, 207 Grace St., Wilmington, N. C.

25 BRASS CONDENSER PLATES, 5½x6 IN., 22 gauge, drilled 1 hole each, in exchange for 15-plate rotary variable condenser or pair Brandes 2000-ohm head phones. W. H. Corbett, Cuyahoga Falls, Ohio.

SET OF 4 FIRST-CLASS BOXING GLOVES, in very fine condition, scarcely used; will exchange for 1-in. spark coil or some good make ferron detector. Joseph E. Ayer, North Franklin, Conn.

WANTED — GOOD SENDING OUTFIT AND Brandes phones; I offer an expensive receiving outfit mounted on large mahogany case; a new $10 mirroscope, a 5-inch film tank and 3-inch coil, and a large railway set with tracks and switches. R. Hall, Peddie Inst., Hightstown, N. J.

WILL EXCHANGE A 1½-in. BULLDOG SPARK coil, 1 auto coherer, and the following books for anything electrical that you have: 1 Telephone Construction, etc., by W. H. Radcliffe and H. C. Cushing, Jr.; 1 A B C of Electrical Experiments, by W. J. Clarke; 1 Electric Wiring, by Branch; 1 Catechism of Electricity, by Hawkins; 1 Machine Construction and Drawing, by Frank Castle. G. E. Stewart, Shyville, Ohio.

"RUNNELL" SPECIAL DOUBLE CONTACT ADjustable 150-ohm relay, costing $8, and telegraph key and sounder, costing $5.75; also 1 wound primary and secondary for ½-in. spark coil, and 2 wound primaries and secondaries for ¼-in. coils, together with vibrators for same; will exchange for small 110-volt alternating current motor or 75-watt dynamo. Douglas Slocombe, 1521 Arbutus St., Vancouver, B. C.

WILL EXCHANGE THE FOLLOWING FOR A loose coupler or large double-slide tuning coil: 1 relay, wound for 150 ohms; 1 W. U. telegraph sounder; 1 pair of hockey skates, size 11; all in good condition. Harold Hurley, P. O. Box 114, Lake Como, N. J.

AN OSCILLATION TRANSFORMER, 2-SLIDE tuner, 1-in. Mesco coil, stepdown transformer, steps 110 v. 60 cycle down to 0, 6, 12, 18 volts, plates for variable condenser, in exchange for wireless instruments. W. Van Slyck, 636 Main St., Lake Geneva, Wis.

WILL EXCHANGE A 3-H.P. GASOLINE ENgine for good small lathe or standard make storage battery. Samuel Cohen, 573 Blake Ave., Brooklyn, N. Y.

HAVE 3 LBS. ENAMEL WIRE, 34 B. S. WIRE, and armature about 2 or 2 1-16 by 2 in. long, and field magnet for same; armature is wound and has commutator, (12 segments); generates 12 v. 4 a.; want a J. J. Duck Ferron detector and good key or a 6-in. Red Devil water motor and key. A. Spartana, 1110 Thomsen St., Baltimore, Md.

HAVE A ½-KW. COIL AND INTERRUPTER, cost $10; 1 standard wireless key, cost $2.50; No. 2A folding pocket Brownie camera, with carrying case and extra lens, cost $10; high-grade developing and printing outfit, cost $8; will trade separately or all for a 1-kw. transformer. W. G. Finch, 523 Sorrence Rd., East Walnut Hills, Cincinnati, Ohio.

WILL EXCHANGE 1 STORAGE BATTERY Exide, 7 plates, made by the Electric Storage Battery Co. Exide Type 68, 15 a. p.; exchange for 1 or 1½ in. spark coil. George T. Frazier, Janvier, N. J.

WILL EXCHANGE THE FOLLOWING FOR motorcycle: 2 D. C. or A. C., 110 v. desk fans, one 4 x 5 plate camera; one post card projector, one mechanical drawing set, several electrical blue prints; also several other wireless and electrical goods; also Edison phonograph. Don't call, write J. Bruell, 518 East 89th St., New York City.

LARGEST TYPE TUNER, 3-BAR HAND MAGneto, 1 pole changer, 1 galena detector, 5-in. Geissler tube; also 1-in. Wallaston wire No. .0001; also many sensitive minerals; will trade any item above, separately or all, for Ferron detector, or anything in wireless line. Wm. L. Harrison, Box 64, S. College St.

WILL EXCHANGE OSCILLATION TRANSformer, 1 500-ohm phone, 1 3-slide tuning coil, portable receiving set, for 1-kw. open or closed core transformer. H. Goldberg, 127 N. Desplaines St., Chicago, Ill.

WANTED—GOOD TENT; WILL GIVE WIREless and electrical instruments for same. D. K. Cooper, 239 Westminster Rd., Rochester, N. Y.

WILL EXCHANGE, SINGLY OR IN LOT, 3 75-ohm receivers, battery, telephone, 2 long-distance telephone transmitters, 2 keys, 2 sounders, 4 ohm, silicon detector, 500 ft. aerial wire, 2 5-bar A. C. magnetos; want dynamo motor, about 15 volt, 1000 ohm, phones, water motor, loose coupler. Jim F. Davis, 206 Pearl St., Somerville, Mass.

WILL EXCHANGE 1 PAIR OF 1000 OHM phones, complete, with nickel-plated head band and cord; also a rotary spark gap, run by Knapp dynamo motor; for an audion of reliable make and a rotary variable condenser. Louis Green, 126 Central Ave., Waterbury, Conn.

WILL EXCHANGE A PAIR OF RECEIVERS, 250 ohms each, complete, with split head band and cord, and a 100-ampere lightning switch, S. P. D. T., for a pair of Brandes receivers, or will trade either one for a Murdock detector. Ralph Knouf, 1344 21st St., Des Moines, Iowa.

HAVE BOOK, "ELECTRICITY FOR YOUNG People," cost $3.50, to exchange for electrical or wireless instruments. Clifford E. Jones, 513 E. 10th St., Ada, Okla.

WILL EXCHANGE A $15 3-LIGHT MICROscope for rotary variable condenser and head set. Anton Wilson, Stromsburg, Neb., Box 74.

FOR EXCHANGE — A MODEL AEROPLANE, which has made many successful flights, in good condition, for a volt or ammeter, or an interrupter for use on 110 volts, A. C., 10 amp. John O'Connell, 6218 Ellis Ave., Chicago, Ill.

ANY ONE HAVING A PAIR OR SINGLE phone with head bands will do well by writing to me; give name and the number of ohms of phones; state what is wanted in exchange. R. D. Schlichter, Sellersville, Pa.

WILL EXCHANGE 1 MAGNETO TEST SET, IN polished mahogany case; 1 splitdorf auto coil; 1 ¼-in. coil; 1 aluminum wire helix, with gap inside and 4 watch-case receivers, minus covers, for X-ray apparatus or something of equal value. A. Shaney, 5713 Curtiss Ave., Cleveland, Ohio.

WANT 2 ROTARY VARIABLE CONDENSER and a J. J. Duck $6 loose coupler; I have a Freesden sliding plate, variable condenser and parts for 150 ampere lightning switch, D. P. S. T.; also other apparatus that I wish to trade for wireless goods. Charles Hewitt, R. F. D., Box 110, R. 1, Oak Harbor, Ohio.

A COMMERCIAL TYPE TRANSMITTING SET: 3-kw., open core transformer; United heavy key; hot wire meter; ammeter; voltmeter; helix, condensers, oil type; will exchange for motor cycle; must be in excellent condition and standard make. Chas. H. Collins, Somers Point, N. J.

WILL EXCHANGE A STAMP COLLECTION OF about 700 stamps, mounted in album, value $60; 2 Scott's catalogues, and about 100 duplicates, for wireless apparatus. Herbert Hodder, Box 223, Detroit, Minn.

WILL EXCHANGE HAND DRIVE FOR 1000-ohm receiver and head band; also have 1 ½-pint leyden jar or a $2 textbook of mechanics, for induction coils, by Norrie. F. Copeman, 1253 Amsterdam Ave., New York City.

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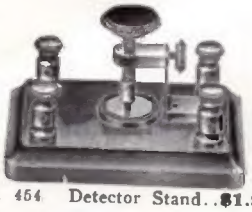

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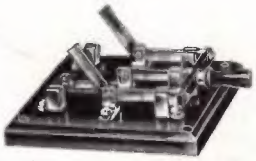

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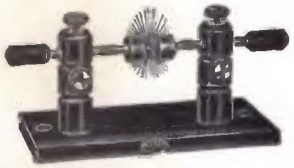

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